

# Popular Science

FOUNDED **MONTHLY** 1872

INVENTIONS  
DISCOVERIES  
RADIO  
AUTOMOBILES  
AVIATION  
HOME WORKSHOP



OCTOBER

Strange new gas masks to protect animals in warfare

25 CENTS

**Beginning—The Story of Houdini—Page 16**



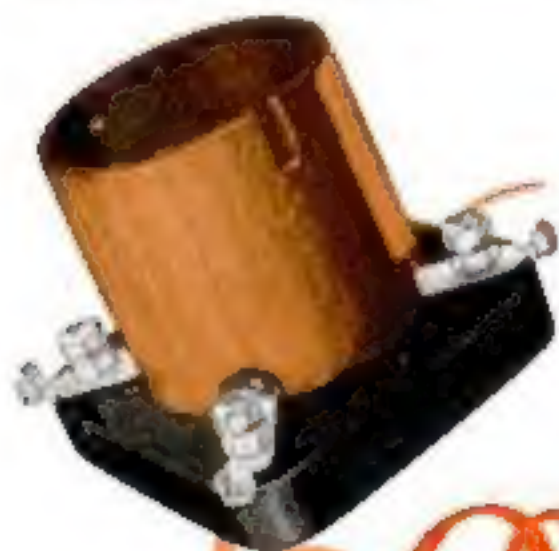
# Now! Quality at a New Low Price

## The Perfected C-H Rheostat

Designed to radio engineers' specifications. Revolving drum type with one hole mounting. All spring tensions adjusted at factory and undisturbed by mounting. Instrument cannot turn on panel. Very small size—less than  $\frac{1}{2}$  inch back of panel and narrower than standard socket. Operation smooth and quiet. 6 ohms, 15 ohms, and 30 ohms—perfect control for all tubes and their combinations.

## C-H Radio Potentiometer

Similar in construction to the perfected rheostat. 400 ohms and only a little larger than a silver dollar. Perfect, smooth operation—no back lash or sticking. Price \$1.00.



Operating parts built as unit—the C-H Perfected Rheostat is not dismantled for mounting on panel. Rheostat is locked in place and knob positioned without a single set screw.

## The C-H Low Loss Socket

The revolutionary socket design that created a sensation everywhere. Thin ORANGE Bakelite shell. Base of heatproof Thermoplastic—terminals cannot loosen under heat of soldering iron. Contacts grip both sides of each tube prong and are SILVER plated to prevent corrosion losses. Preferred by careful builders at 90¢—now 60¢ because of huge production savings.



## C-H Radio Toggle Switch

The newest idea in panel switches. ON or OFF with a flip of the finger. Beautiful appearance and simple one hole mounting—nest etched plate for panel provides definite indication. Quiet, easy operating switch mechanism.



## The C-H Radio Switch

The original radio switch. Millions in use. One hole mounting—high capacity mechanism. The only radio switch approved for 110 volt circuits by the Underwriters Laboratories. Ideal for battery-less sets or higher voltage circuits. Many switches now have buttons to look like the C-H but the patented mechanism cannot be duplicated. Demand the orange and blue box for satisfaction.



## The C-H Radioloc

The radio switch that locks with a key. Just the thing for the home with children—for the protection of tubes and batteries. One hole mounting—quiet operation. Like all C-H radio parts, packed in orange and blue boxes. Look for them—and the C-H trade mark.

The name Cutler-Hammer has held an enviable position in radio. Consistently from the earliest days has the C-H trade mark been synonymous with proper design and unusual precision. Radio builders everywhere justly had faith in these foremost engineers and millions of their radio parts in the orange and blue boxes have helped build receiving sets of quality.

## Better Sets at Lower Cost

These millions of sales have brought down manufacturing costs and today this quality carries no premium. Demanding the C-H trade mark now not only insures satisfaction, but provides a saving. Dealers everywhere are ready to serve you. If yours has not yet stocked any C-H part you desire, send us his name and we will see that you are supplied.

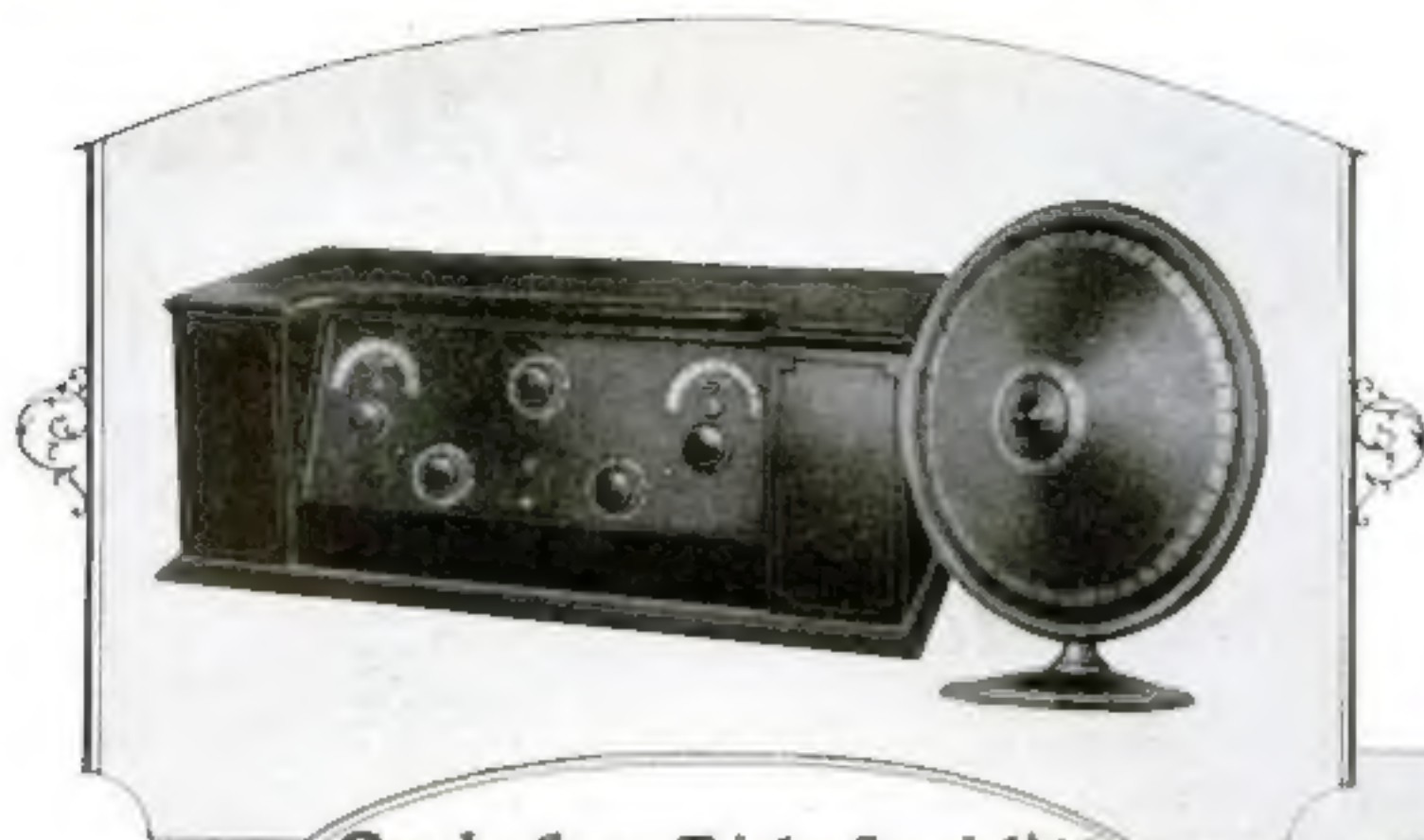
## THE CUTLER-HAMMER MFG. CO.

Member Radio Section, Associated Manufacturers of Electrical Supplies  
MILWAUKEE AND NEW YORK

# CUTLER-HAMMER

Buy Your Radio Parts by Name





**Crosley Super-Trirdyn Special \$60.**  
**Crosley Musicone \$17.50**

## 3 Tubes Now give Results Equal to 5

**S**OUNDS improbable doesn't it? But it is a scientific truth, first demonstrated in the Crosley laboratories and then confirmed by the performance of thousands of Trirdyns the country over.

Employing but 3 tubes, the Crosley Super-Trirdyn consistently equals 5 and often surpasses, the more costly 5 tube sets in performance.

These astonishing results are simple to explain. Instead of passing the incoming signal *once* through each of 5 tubes, Crosley design passes it through two of the three tubes *several times*, each time building up its strength and adding to its volume.

Even the technically uninitiated can see the advantages: simplicity instead of complexity; fewer dials to adjust; sharper accuracy in selecting stations; greater clarity; greater volume.

Yet that is not all. Simplicity of design and fewer parts make manu-

facturing costs lower and bring about a lower cost to you. This, combined with the economies of gigantic production makes it possible to offer this quality receiver, the Super-Trirdyn, at this remarkably low price. For Crosley is the world's largest builder of radio sets—owning and operating parts factories, cabinet woodworking and assembly plants.

Listen to a Crosley Super-Trirdyn under the most exacting conditions. Make an unbiased comparison with the most costly receiver you have ever heard. Forget the radical difference in price.

Then will you understand why the Crosley Super-Trirdyn represents a genuine achievement in radio performance and value which all America was quick to recognize and reward with increasing sales.

Write for attractive illustrated catalogue. Authorized sales and service stations everywhere.



### Super-Trirdyn De Luxe Combination

Super-Trirdyn De Luxe . . .	\$ 44.00
Musicone De Luxe . . . . .	17.50
Console Table . . . . .	15.00
Complete . . . . .	\$112.50

ADD 10% TO ALL PRICES WEST  
OF ROCKY MOUNTAINS

Crosley manufactures receiving sets which are licensed under Armstrong U. S. patent No. 1,113,140 and priced from \$9.75 to \$60.00 without accessories.

Crosley owns and operates WLW first remote control super-power broadcasting station.

# CROSLEY

BETTER—COSTS LESS

## RADIO

THE CROSLEY RADIO CORPORATION, CINCINNATI, OHIO

Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.



# Popular Science Monthly

The Magazine of Invention and Discovery

OCTOBER, 1925; Vol. 107, No. 4

25 cents a Copy; \$2.50 a Year

Published in New York City at

250 Fourth Avenue



## Coming Next Month

**Do You Have Trouble Driving in Heavy Traffic?**—Gus and Joe's valuable hints in next month's issue will help you.

**How to Use Glue in Your Home Workshop**—A national authority on glue and its uses offers practical advice on how to insure joints that will hold in doing common household repairs, or in building furniture and doing other wood work.

**The Last Word in Radio**—New facts about low-loss coils from the Radio Laboratory of the Popular Science Institute of Standards; how to build a good crystal set; hints for installing a commercial receiver—all in next month's Radio Department.

**More than 200 other fascinating articles and pictures**, giving you all the news of radio engineering, science and invention, strange and unusual things people are doing, together with practical ideas for the automobile, the home, the home workshop, and the use of tools and machinery.

**HOUDINI**, the most mysterious man in the world, begins his own fascinating story in **POPULAR SCIENCE MONTHLY** next

month — a chronicle frankly revealing astonishing secrets from a life packed with magic and romance. When you read Raymond J. Brown's vivid picture of Houdini the man, on page 16 of this issue, you won't want to miss a single word of this amazing series, starting in the November number.



Houdini (right) explaining tricks of fraudulent mediums to Raymond J. Brown, whose fascinating character portrayal of the world's most mysterious man appears on page 16 of this issue. Houdini's own story begins next month.

## POPULAR SCIENCE MONTHLY

Issued monthly. Single copy, 25 cents. Yearly subscription to United States, its possessions, and Canada, \$2.50; foreign countries, \$3. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Dupellen, N. J. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Copyright, 1925, by the Popular Science Publishing Co., Inc. The contents of this magazine must not be reprinted without permission. In presenting in its editorial columns numerous stories of new products of applied science, **POPULAR SCIENCE MONTHLY** does not endorse the business methods of the individuals or concerns producing them. The use of **POPULAR SCIENCE MONTHLY** articles, or quotations from them for stock-selling schemes is never authorized.

G. B. Capun, President and Treasurer; R. C. Wilson, Vice-President; A. L. Cole, Secretary.

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And Other Timely Articles and Pictures





The Brandes Speaker—Type H—a simple, attractive, quality horn with a smart unique finish. Adjustable . . . \$18.

# Acoustics by Brandes

ACOUSTICS is the science of sound. Radio acoustics is the science of transforming electrical impulses into audible sound—the new and absorbing study of real reproduction of voice and music. And in this field Brandes have been pioneers since 1908.

Today, along with an era of remarkable new speakers by Brandes, has dawned an epoch of Brandes acoustics built into better radio sets.

So, whether you buy a set and a speaker or a set with a self-contained speaker, insist on "Acoustics by Brandes" and be assured of finest tone quality and uniformly good reproduction.

The new phonograph attachment—same size as Type H Speaker. Adjustable. . . . \$10.



Brandes Cabinet Speaker of mahogany in the popular brown finish. Same tone quality and volume as Type H Speaker. Adjustable. . . . \$30.



The Superior Matched Tone Headset to tune in with. To listen undisturbed—and undisturbed. . . \$4.50.



Brandes adjustable Table-Talker with the goose-neck horn. \$10.



# Brandes

experts in radio acoustics since 1908





# Money Making Opportunities for "Popular Science" Readers

A "True Story" from a Reader  
of POPULAR SCIENCE MONTHLY

## It Is Easy to Succeed

A WOMAN wrote us a letter with such a big message for every reader of POPULAR SCIENCE MONTHLY that we reproduce it in full. Her letter proves again that it is easy to succeed—if you really want to.

POPULAR SCIENCE MONTHLY:—

The Advertising Opportunity that interests me most is the one that has helped our family.

My husband was a day laborer until he decided to study law. He wrote the . . . . . School, advertised in your magazine, received his books promptly, studied nights, completed his course, took examinations, and passed.

He still is climbing onward. Was elected to the State Legislature last year and is candidate for Attorney General and has a good private practice. An advertisement fired his ambition and he is still pushing forward.

Mr. V. E. A.

From day laborer to the State Legislature of Texas! In the clipped phrases of this letter is the material for a three-act drama or a 300-page novel.

Mr. V. E. A. and the tens of thousands of other men who have used special training to raise themselves from the ranks, prove that America is still the land of opportunity. But the opportunities are for the men who specialize, the men who deliberately pick out the work they want most to do and then fit themselves for it.

Through its pages of advertising of schools and educational books, POPULAR SCIENCE MONTHLY has started thousands of men on the road to success, big money, and all that big money brings a man and his family.

Whatever you want to be—a lawyer or a master carpenter, a salesman or the owner of a garage, an artist or an electrical expert, a public speaker or a pharmacist—there are schools and books advertised in the MONEY-MAKING OPPORTUNITIES SECTION of POPULAR SCIENCE MONTHLY ready to help you secure the specialized training you need to get ahead.

It isn't hard work to make money. It is a matter of intelligence, of picking out the work you are most interested in, and then fitting yourself for the work you have selected.

The boss doesn't work any longer hours than his men. But at the end of the week he has made twice, three times, or five times as much as the men who work for him.

And at the end of the day, instead of fighting his way into an overcrowded streetcar, he steps into his own automobile and goes home to his family—

a prosperous, successful American business man, with money in the bank and all the good things of life at his command.

If you, too, would have your own car, your own home, and all the other good things of life, determine now to spend the eight hours a day you must work anyhow in doing something you enjoy and be the boss instead of the wage-earner.

Start on page 146 and study every advertisement in the MONEY-MAKING OPPORTUNITIES SECTION. Decide what most you would like to do and then fill in the coupons or

(Continued on page 148)

### \$100 in Cash Prizes

For the best letters in answer to the questions:

What advertisement in the MONEY-MAKING OPPORTUNITIES SECTION interests you most—and why?

we will pay \$100 in cash prizes.  
For full details—

See Page 146

**You will find Scores of Opportunities for Making More Money in the "Money-Making Opportunities" Department, starting on page 146 of this issue.**



# TRIMO



## - all parts replaceable - at small cost!

THIS picture shows at a glance one of the big features that makes the TRIMO Pipe Wrench the economical choice of the householder, farmer, master mechanic and American industry. When the INSERT JAW in the handle of the TRIMO becomes worn or dull through many years of service, all you have to do is to spend a few cents for a replaceable jaw instead of buying a new handle which is a large portion of the cost of a new wrench. This same replaceable feature applies to all TRIMO parts, making this rugged tool low in FINAL COST.

But it's the masterly design of the TRIMO that most wrench-wise users admire. Note the NUT GUARDS, for instance, how they protrude slightly above the wheel, thus keeping the wrench in perfect adjustment when used in close quarters or laid down. TRIMO has a STEEL frame that WILL NOT BREAK—your guarantee of safety and durability.

For these and many other reasons, people who KNOW never quibble about paying a few cents more for this—America's super-quality Pipe Wrench. At all hardware, mill and plumbing-supply stores. Insist on TRIMO—accept no other.

The TRIMO is made in eight STEEL handle sizes, 6, 8, 10, 14, 16, 18, 20 and 24 inches in four WOOD handle sizes, 6, 8, 10 and 14 inches. The 10-inch WOOD handle household size (see small illustration) comes packed in individual cartons.

TRIMONT MFG. CO., ROXBURY, MASS.

America's Leading Wrench Makers  
For Nearly 40 Years

Besides Pipe Wrenches, the TRIMO line includes Pipe Cutters, Pipe Vices, Monkey Wrenches and Chain Wrenches. The name TRIMO stamped on any tool is your guarantee of quality.

*Resound Corp.*



# How Our Subscribers Make Use of the Institute of Standards

## One Day's Mail

Besides letters from all over the United States, the Popular Science Institute of Standards receives letters from every corner of the world.



**U**NCLE SAM'S postmark is not the only one on the thousands of letters that come to the Popular Science Institute of Standards. Readers from every continent in the world are among those who have taken advantage of the service the Institute offers.

The writers of these letters are interested in different kinds of radio and tool equipment, but they all have the same essential reason for writing to the Popular Science Institute of Standards: They want to "play safe" in their selection of such products, and they know they will be safe if they are guided by a staff of expert engineers when they buy.

The inexperienced, as well as the experienced, realize the advantage of restricting their choice of radio and tool products to ones that have passed rigid scientific tests in the laboratories of the Popular Science Institute of Standards. Men engaged in various fields of radio work, as well as some of the largest dealers and jobbers in radio apparatus in the country, are using the List of Approved Products of the Popular Science Institute as their guide in buying radio equipment. Likewise, mechanics and hardware dealers of many years' experience ask what tools we have approved.

Here is a letter, typical of many that come to the Institute:

I am taking the liberty of including an advertisement from our local newspaper of the — radio set, and I would respectfully request your opinion as to its efficacy.

I have considerable faith in the products approved by the Popular Science Institute and feel that my judgment in adopting the policy of buying only such products has saved me from making serious mistakes. I would therefore appreciate your endorsement before I send the order for this radio set.

—P. M. J., San Francisco, Calif.

A man who is general storekeeper for a railway system writes as follows:

I have read with keen interest of the good work that you are doing with regards to approving tools and radio products that have withstood scientific and practical tests in your laboratories.

Will you be good enough to send me a list of such tools as have met with your approval. This, I am sure, will be of service to me, not only in my business, but for my personal purchases, as I am very much interested in tools of all designs and types and am continually purchasing them.

Before closing, I would like to say it is my opinion you have started something in this work that will be of enormous value to users of tools.—S. G. M., New York, N. Y.

Many readers who have been guided by the findings of the tests of the Popular Science Institute of Standards write later to assure us of the satisfactory service received from the equipment purchased on our recommendation and, almost invariably, they add a statement similar to

the following: "I told my friends about the great work you are doing and many of them consulted the List of Approved Products you sent me in making their own purchases of radio and tools."

All equipment approved by the Popular Science Institute of Standards has passed rigid tests made under the direction of Prof. Collins P. Bliss, who is head of the Mechanical Engineering Department and director of Testing Laboratories at New York University, besides being director of the Popular Science Institute of Standards.

Under his experienced guidance, and with \$300,000 worth of testing equipment at their command, a staff of expert engineers is constantly at work testing tools and radio products.

Information regarding the results of these tests is available to all readers of **POPULAR SCIENCE MONTHLY**. Inquiries and requests for Lists of Approved Products should be addressed to the Popular Science Institute of Standards, 250 Fourth Avenue, New York, N. Y.

**IT** IS obviously impractical for even as completely organized a bureau as the Institute of Standards to test all products listed in tool or radio catalogues advertised in our columns. Only tool and radio products specifically advertised in **POPULAR SCIENCE MONTHLY** are tested and approved by the Institute.

## Send for List of Approved Products

**POPULAR SCIENCE MONTHLY** will be glad to furnish on request a list of Radio and Tool Manufacturers whose products have been approved by the Institute, after rigid laboratory tests.

## POPULAR SCIENCE Monthly Guarantee

The above seal on an advertisement indicates that the products referred to have been approved after test by the Popular Science Institute of Standards.

Popular Science Monthly guarantees every article of merchandise advertised in its columns. Readers who buy products advertised in Popular Science Monthly may expect that these products will give absolute satisfaction under normal and proper use. Our readers in buying these products are guaranteed this satisfaction by Popular Science Monthly.

THE PUBLISHERS.





# new **ULTRADYNE**

## MODEL L-3



To protect the public, the U. S. Government has established a seal of approval for all radios. The Ultradyne Model L-3 has this seal of approval.

### *No Dials—No Panel Built-in Loud Speaker*

**I**F the Ultradyne Model L-3 were merely another new receiver, its influence in the industry would be little felt.

But it is in reality the first step in the general revision of radio receiver design which is bound to follow its advent.

For the new Ultradyne Model L-3, is an entirely new type of receiver—radically different in appearance and method of operation—gives finer results from finer engineering. Employs six tubes—is completely assembled and wired, ready for the tubes and batteries.

It has no dials—no panel—no needless controls. Two levers, an exclusive Ultradyne feature, give you control of the entire broadcast program. Its operation is practically automatic—simply slide the pointer to the station you want and adjust the volume control, soft or loud as you like it.

Loud Speaker and "B" Batteries self enclosed in a beautiful cabinet that is far from mechanical in design and is an ideal mahogany furniture piece for the most charming home.

This new Ultradyne Model L-3 gives you the best there is in radio—truer reproduction than you have ever known before.

**PHENIX RADIO CORPORATION** 114-A East 25th Street  
New York

Ask your dealer for a demonstration. The contrast between the Ultradyne and other receivers is so marked that the desire to own one will be bred there and then.

# \$135

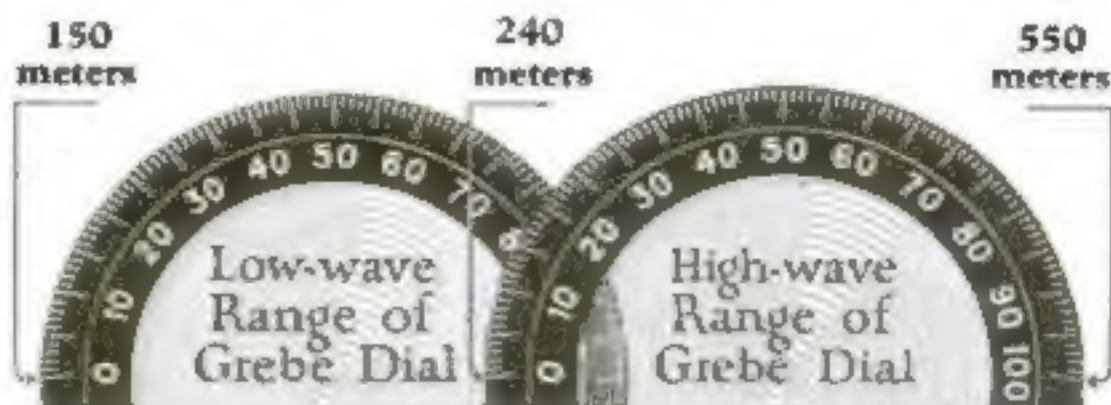
Write for  
descriptive folder







Grebe  
Binocular  
Coils



## The Synchrophase Now Reaches from 550 Down to 150 Meters

**T**HE Synchrophase, with the new Low-wave Extension Circuits, will receive all present and projected stations. It is really two receivers in one.

This great range is accomplished by means of an automatic switch which enables one dial to cover two wave ranges. The first, from 550 meters down to 240, corresponds to the practical tuning range of the usual receiver. The second overlaps this and goes down to 150 meters. Simply move the center dial past the 100 mark for the high range, and beyond the zero mark for the low range.

This low-wave reception opens up over 100 existing stations, broadcasting on less than 240 meters, and not reached by other sets. This will be especially valuable later, when stations generally begin to use lower wave lengths. The Synchrophase is thus equipped for the future.

*Ask your dealer to demonstrate this new feature; then compare.*

A. H. Grebe & Co., Inc., Steinway Hall, 109 West 57th Street, N. Y. C.  
Factory: Van Wyck Blvd., Richmond Hill, New York  
Western Branch: 443 S. San Pedro St., Los Angeles, Cal.

The  
**GREBE**  
**SYNCHROPHASE**  
TRADE MARK REG. U. S. PAT. OFF.

This Company owns and operates stations WAHQ and WBOQ; also low-wave rebroadcasting stations, mobile WGMU, and marine WRMU.



It is written  
"Where there is  
zeal there is  
reward."  
The merit of the  
Synchrophase  
has long been  
proven.

*Grebe*



The Synchrophase  
is also supplied with  
base for batteries.



All Grebe apparatus is covered by patent granted and pending.





## Gas Masks *for* War Horses

*Strange Hoods Devised to Save Chargers, Dogs, and Pigeons from Deadly Fumes*

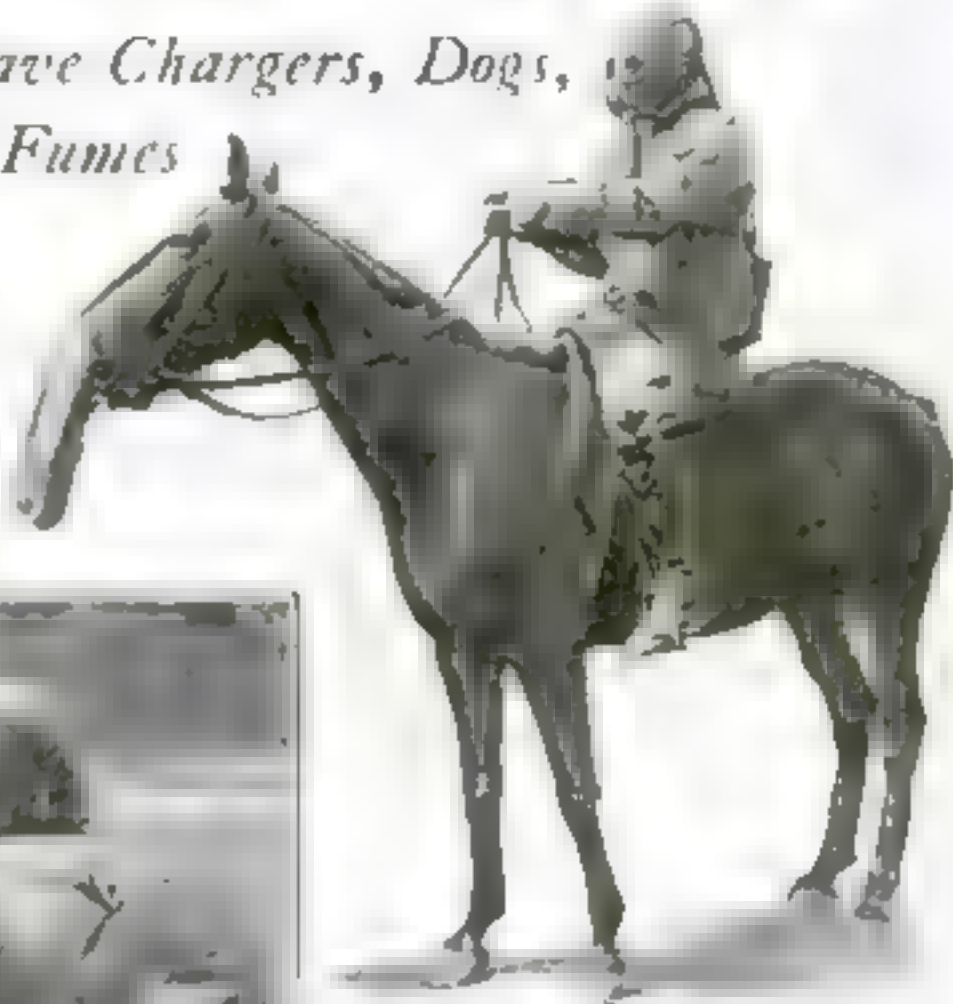
By Capt. Adrian St. John

Corps Area Chemical Officer  
United States Army



**Masked Steed of the Future?**

New gases affecting the eyes of horses may be used in the future. The mask shown here is equipped with a tube connected with a tank of colorless, odorless chemicals and the horse's face



**Used in Recent Tests**

This long nosebag impregnated with chemicals is the latest type gas mask for horses. It was used in the recent tests against the new development in gas powerful enough to affect the horse's eyes

**A**SKY dark with airplanes, each carrying a quarter of a ton of death-dealing gas! Huge cities laid waste and arm is rendered impotent! This frightful picture of future war has taxed the ingenuity of the Chemical Warfare Division of the United States Army in the production of protective devices.

Amazingly effective gas masks have been developed for human beings. And now efforts are being turned toward masks for animals—horses, dogs, and pigeons—all valuable aids in warfare.

As far as horses are concerned, Nature has helped us in a very peculiar fashion. She has made horses' eyes insensitive to all of the ordinary forms of war gas. And, in addition, Nature has provided that horses shall not breathe through their mouths.

Thus, all we needed to do was to design a mask that would cover the horse's nostrils in such a way that the animal would be compelled to breathe through, and one of sufficient filtering surface to allow the animal to breathe easily.

The problem has been solved so well



**Like an Overgrown Mouse**

Because the dog breathes through his mouth and his eyes and ears are sensitive to gas, his queer mask covers the entire head, making the animal look like an overgrown mouse

that, in a recent test at Governor's Island, a horse carrying a rider went through a thick cloud of gas without suffering the least harm. The gas mask worn by the soldier was of the standard type, while the horse was fitted with a mask that resembles a huge feedbag, made of specially prepared cloth, impregnated with the special compound that absorbs the gas.

Curiously enough, horses' hoofs must be protected against the effects of gas—a problem that has been solved by the use of leather, cloth-lined boots that are laced on tightly.

Dogs presented problems more nearly

parallel to those encountered with human beings. Their eyes and ears are sensitive to gas. They breathe through their mouths even more than do humans. These considerations made it imperative that the mask designed for canine use should cover the entire head of the animal, as shown in the center illustration.

Carrier pigeons do not wear individual masks. That method of providing for them proved utterly impractical in actual warfare. Pigeons always are carried in crates until released. The mask for pigeons, therefore, consists simply of a cloth bag with a drawstring. The bag is slipped over the crate and the drawstring pulled up tightly. The cloth of the bag is sufficiently porous to admit plenty of air, yet it absorbs the gas.

**W**HEN it comes time to release a pigeon, the bird is withdrawn as quickly as possible and thrown high in the air. Spiraling straight up, the winged messenger is above the gas cloud before any damage is done.

Investigation and experimental work still are going on. It is possible that some future development may make masks fitted with goggles, or a complete covering for the horse's body an absolute necessity



# Inventive Genius on

*How Scientific Devices and  
Clever Tricks of Training  
Add to Thrills of Football*

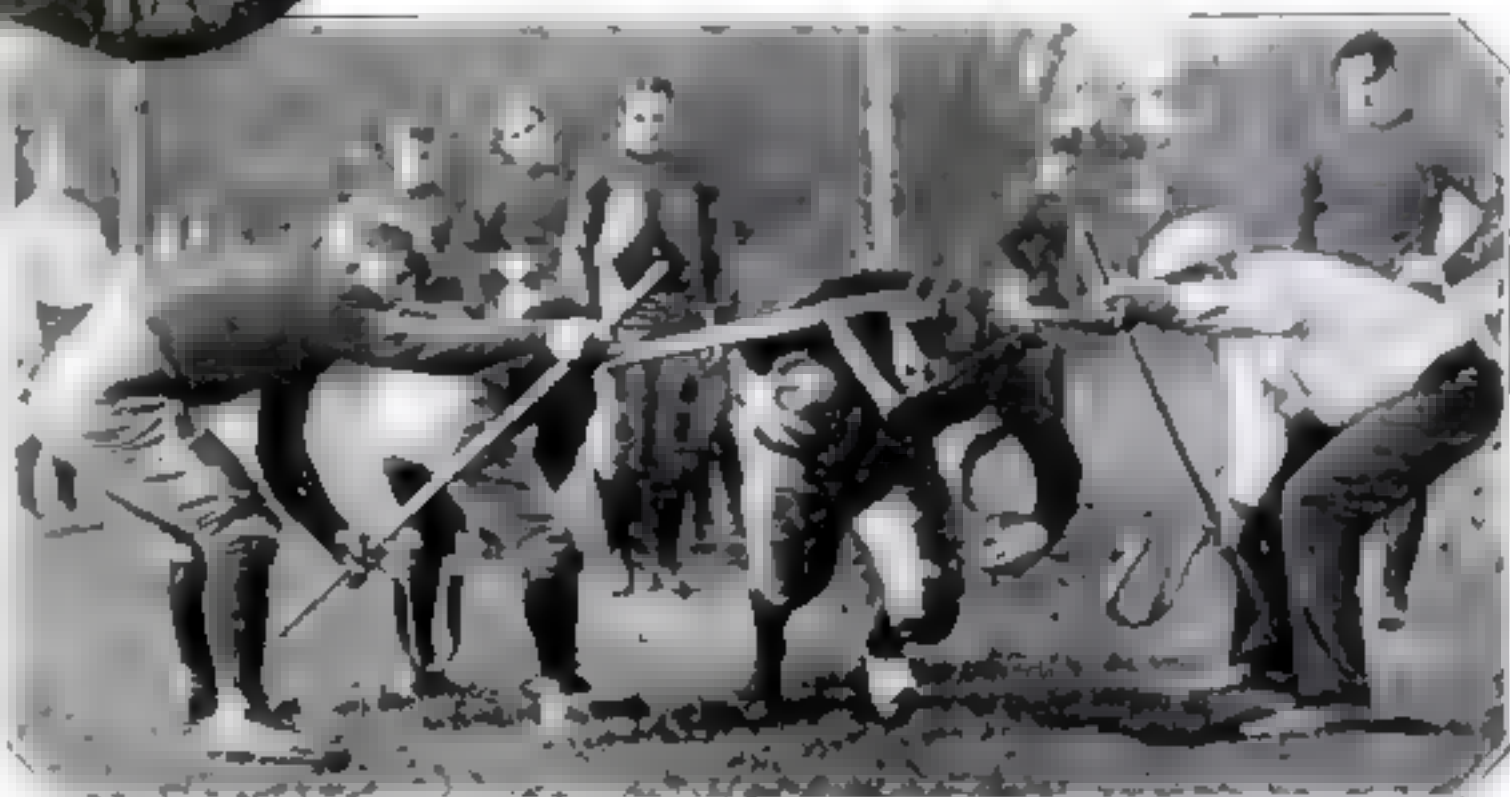


## Latest in Headgear

Replacing the long shaggy locks of old-time football warriors, this new style headgear protects the cheeks, jaw and the skull.

## Rucking Harness

To aid backfield men to develop driving power, Larry Bankart, former Dartmouth star, devised the ingenious contraption shown at right, held by two stunts.



**W**HILE Sol Metzger, once a famous star on the Pennsylvania football team, was coaching the West Virginia eleven some years back, he reported for work one fall to find a squad composed largely of inexperienced men. They were agile, strong, robust, and full of the desire to play football, but they were lacking, in many instances, even the rudiments of the gridiron game, especially tackling.

Metzger worked patiently, trying to teach them the knack of hitting their men low. But the trick of diving at an opposing runner and nipping him just above the shoe laces comes naturally to but few. The tendency is to go in high, grabbing out at the runner like a drowning man clutching at a straw. This leaves the would-be tackler an easy mark for a good stiff-arm jab by the runner.

Metzger labored persistently, but to little avail, and the situation was growing desperate when one night after practice, he thought of a scheme. When the men went out for practice the next afternoon, they found stretched in front of the row of tackling dummies, at a height of some three feet, a thick, wide board that bore in large black letters the legend, "TACKLE LOW."

The first order of practice that day was a long session at hitting the dummies, in which the men naturally had to plunge under that board. The result was startling. Before the end of the season, Metzger's rookies had developed into a band of savage tacklers.

Football is rich in similar experiences, wherein necessity has mothered invention. The human machines that thrill bleacher crowds today are products of training tricks and devices that are a

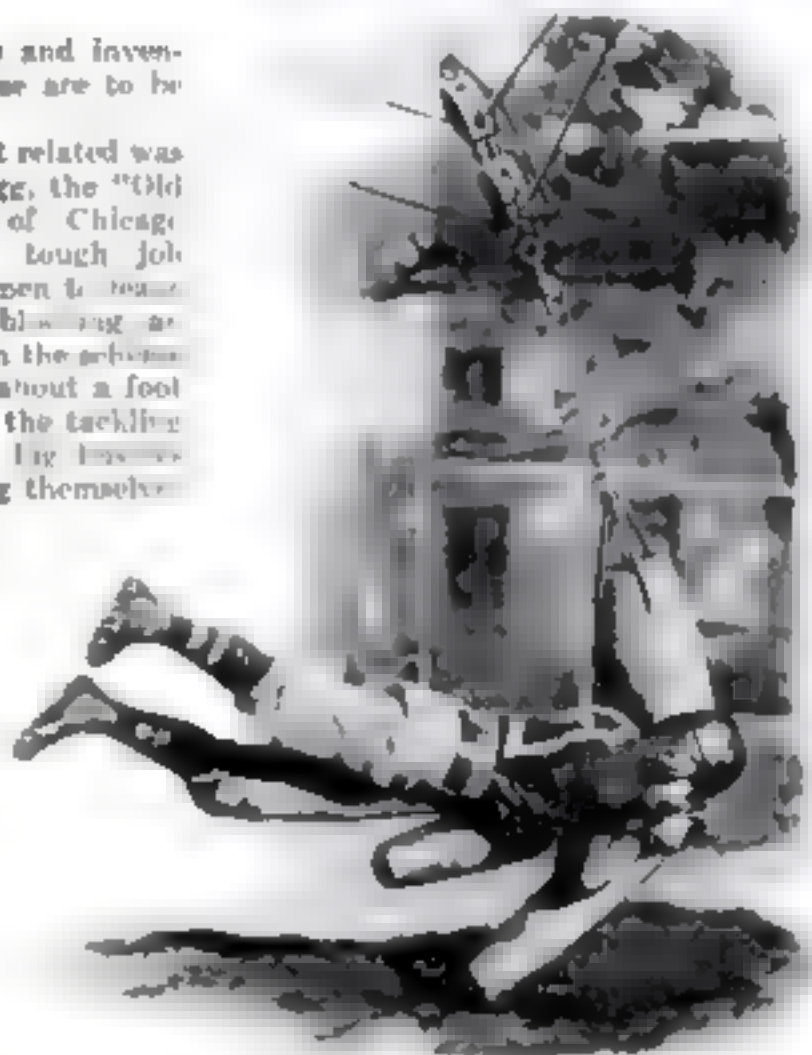
direct application of science and invention. This fall more of these are to be used than ever before.

A stunt similar to that just related was conceived by Alonzo A. Stagg, the "Old Man" of the University of Chicago eleven. Stagg found it a tough job teaching his big, heavy linemen to keep their feet in tackling or blocking an opponent. Finally, he hit on the scheme of stretching a two-by-four about a foot from the ground in front of the tackling dummies, and having these big linemen clear that board in launching themselves at the dummies. They left their feet all right—they had to, or else trip over the board.

**A**NOTHER scheme of Stagg's was the introduction of the Ghost Ball, which was to become famous throughout the country. Each fall, Stagg found that not nearly enough daylight was available for drilling his charges. As soon as dusk began to fall, it became next to impossible to follow the ball in passing. Then he hit on the idea of having a dozen or so balls painted with a luminous white paint. This solved the problem.

Gil Dobie took another tack to meet similar conditions at Cornell. He had the field strung with high power electric lights.

To Glenn "Pop" Warner, coach of the Stanford University eleven, and former mentor at the University of Georgia, Cornell, the Carlisle Indian School, and



## Downed with a Flying Tackle

Practically every big college team practices with tackling dummies such as this—a stuffed canvas "man" suspended from a trolley in such a way that it goes down to the ground with the tackler.

the University of Pittsburgh, goes the distinction of having introduced possibly more new training tricks and devices than any other man. One of the most important of these is the charging machine,



# the Gridiron

By  
INNIS BROWN

Mr. Brown is a well-known football critic and writer. In addition, thousands of radio fans are acquainted with him through his broadcast reports of big Eastern games. His expert knowledge of the gridiron is based on three years' experience as a player on the Vanderbilt College team, which he captained for one year, and also five years as a football referee.



a contrivance now used quite generally

This device is a heavily built platform, roughly five feet wide and 10 feet long, mounted on small wheels. Along one side, at a height of about 30 inches, runs a wide padded board. The method of use is to load had a dozen men or more on the platform to provide ballast, and then line up from four to six others in a crouching position about the distance from the machine that would separate them from an opposing line. The latter charge against the machine and push it back. Concerted action is necessary to move the device, and unless all charge together, somebody is due for a painful shock. The main idea was to develop driving power in the legs, but the machine also serves to train men in starting together. Very similar in operation is the "bucking machine" used by Coach Bob Folwell in training the Navy gridiron stars. The machine, a large boxlike structure, has heavily padded supports, against which the players charge.

LARRY BANKART, former Dartmouth star and later coach at Colgate, devised a departure from the charging machine, which can be used to help backfield men in acquiring driving power, and at the same time allow them to carry the ball. Bankart's creation, a bucking harness, consists of a leather

collar some 15 inches in diameter, to which four leather straps are attached. These straps are fastened to two wooden staves, which are held vertically by two huskies, while the back carrying the ball runs his way forward, thrusting his head through the collar and catapulting himself forward as far as possible.

The tackling dummy is part of the equipment of practically every college team, and is one of the most useful of training aids. This dummy is a stuffed canvas "man." It is suspended from a trolley wire by an arrangement by which the tackler's weight detaches it from its moorings, so that player and dummy go down together as in an actual tackle.

One thing about such dummies seemed wrong to Walter T. Stall, a football enthusiast of Brockton, Mass.—the dummy remained stationary while the tacklers approached. To simulate real conditions, the dummy should be running, too. With a new device, patented

## He Played with a Broken Neck

This scientifically designed brace enabled Eben Williams to keep on playing right half back for the Georgia Tech eleven even with a fractured neck vertebra.



recently, Mr. Stall has remedied this. His contribution is a portable tackling dummy with leather handles at the top, so that it can be carried by two players, one on each side. These run down the field with the dummy swinging between them, in position to be tackled by a player running from the opposite direction as in the actual game.

In the 50-odd years of football development, there have been many interesting changes both in the game itself and in the matter of equipment and appliances. In the early days an outstanding feature of the player's protective equipment was a thick mop of long, shaggy hair. This abundant capillary adornment, a pair of quilted, padded, knee-length canvas pants, and a sweater of sorts, about completed the player's trappings.

But the tousled hair had its disadvantages. It was too likely to engage the outstretched hand of an opposing tackler. Then some one thought of a leather skull cap, and the headgear of leather came into existence.

IT WAS a rough old game in those days and bloody noses were a common sight, until John Morrill, famous years ago as a professional baseball player, conceived the idea of a nose protector.

He fashioned an appliance of hard rubber that fits over the nose, resting against the forehead, and having a rubber grip to be held between the teeth for keeping it in place. This was the first nose guard. Also came shin guards.

Twenty years ago, just before the first beginning of the game, the football player in full regalia was an imposing and picturesque individual. In addition to the trappings already mentioned, he wore thickly padded moleskin pants—sometimes a union suit—elbow pads, shoulder pads—a pair of cupped leather pockets

(Continued on page 158)



## This Machine Develops Hard-Charging Linemen

Navy huskies are seen here practising with the "bucking machine" used by Coach Bob Folwell, to develop concerted action. To move the machine all players must charge at once.



# Who Will Win?

Sorting a pile  
of entries in  
the \$10,000  
Prize Contest

## Our Great \$10,000 WHAT'S WRONG Contest!

**J**UST 20 days from the publication date of this issue, and POPULAR SCIENCE MONTHLY's sensational \$10,000 "What's Wrong" Contest will be over—at least so far as the receiving of entries is concerned. You have until September 30 to submit your solutions in the final monthly contest—which appeared in the September issue—and for the Grand Prize Contest.

Many of those who have submitted solutions for each set of eight pictures as they appeared, competing for the monthly prizes, now are submitting complete new sets of the entire 32 pictures, as a final effort to win Grand Prizes. This is not necessary, since all solutions submitted monthly by any individual are held and four sets judged as a unit in the Grand Prize Contest.

If, however, you have changed your mind as to the correctness of your original solutions, you may submit, in the Grand Prize competition, as many additional sets as you like, provided they reach the office of POPULAR SCIENCE MONTHLY not later than September 30.

For the past four months a dozen competent and experienced persons have been kept busy sorting entries and giving them the first reading. Each entry has received equal consideration. Those written in pencil on scraps of writing-paper have been handled just as carefully as those more ingeniously and elaborately prepared.

Some of these latter reveal remarkable originality and no little labor. Yet accuracy is the first consideration of the judges, and in awarding prizes, accuracy and clearness will outweigh skill of presentation. Of course, all other things being equal, the most

skillfully presented solutions will win.

Manuscripts have been received at the rate of many hundreds a day, the entries in the aggregate running well up into the thousands. Unfortunately, a large number of entrants forgot to write their names and addresses on their solutions, as stipulated in the rules. These, of course, the judges must disregard.

Contestants live in almost every country in the world. A Hindu from the interior of India cabled in vain for an extension of the time limit, since his copy of the magazine reaches him three months after publication. A missionary in Central Africa made a similar plea. A veteran of the A. E. F., living in a little Normandy village, wrote of the interest of his neighbors in the contest. The South Seas and the Arctic Circle join with every state in the Union in contributing entrants.

**M**ANY of the letters accompanying solutions assured the judges that the writers were certain to win one or more prizes. Several persons sent their

photographs with instructions to use them in connection with the announcement of the awards. One reader asked that the judges send his prize money to an address other than that of his home, that his wife might not take it away from him. Another said he was so sure of winning that he had begun negotiations for a home to be purchased with his prize money from the contest.

**O**F COURSE, even with as many as 580 cash prizes to be awarded, some of the contestants who have worked hard and enthusiastically are bound to be disappointed. Yet every one of the thousands of persons who entered will agree, we believe, that whether they win or not, the contest has been most fascinating and profitable. It has sharpened our wits, stimulated our powers of observation, increased our knowledge of every-day mechanical things, and given us many evenings of worth-while enjoyment.

Of the mistakes that John and Mary have made, some have been simple, others more difficult to find. But each one has held some useful suggestion.

The editors of POPULAR SCIENCE MONTHLY are awaiting the announcement of the first awards in the contest no less eagerly than our readers. And the judges, who are doing their job thoroughly, promise to have the winners of the June contest ready for publication in our November issue, published October 10.

The three judges for the contests—Prof. Collins P. Bliss, Dr. Hazen G. Tyler, and Alexander Senzuke, M.E., E.E.—all are members of the staff of the Popular Science Institute of Standards and their decisions will be final.

### Watch for Winners' Names

**N**AMES of the prize-winners in the first of the four monthly "What's Wrong" Contests, which appeared in the June issue, will be published in our November number—on the newsstands October 10. Winners in the July, August, and September contests will be announced in the December, January, and February issues respectively. The Grand Prize winners will be announced as soon as possible after entries close.



# A Romance of the Microscope

## *The Amazing Story of How Fate, Three Men, and a Hobby Discovered the Cancer Germ*

By Peter Vischer

**T**HE old man was getting along in years. And he hadn't done anything yet. All his life long he had wanted to do something, something that would live through time, something great, monumental, something that would make the name of Gye send forth such a beacon of shining light that even unthinking, careless, hurrying men would remember, halt, and pay homage. There weren't many years left, he knew that, and it began to look as though his ambition were doomed to go to the grave with him.

He had money, old man Gye had, but not much. He didn't have enough to found a school, or build a hospital, or leave some other legacy worthy to bear his name through the ages. No, he couldn't do that. And he had no children to turn to, none to carry on in his name.

Gye frequently bemoaned his fate, his thwarted ambition, as he hurried from the heart of London and through the railway station at Derbyshire, to his home. So it was on this day, when, as happened every morning and every night, he was accosted with a cheery good day

"**A**H, GOOD day, Bullock," he replied, stopping to chat with the station-master, a young chap earnest and serious, who also knew the pangs and pains of ambition. Bullock wanted to be a scientist, but he was poor, and he had to earn his living at railroading, help support an invalid mother, and use only what he denied himself for the only treasure life seemed to hold for him—books. Between trains this youth studied

They often talked of their ambitions, Gye and Bullock—the old man from whom life was ebbing fast, and the young man whose blood was only beginning to boil. And this they did again for some moments, until the older man, his face lighted with sudden inspiration, grasped the younger by the arm and gripped it tight with excitement.

"I am not famous, nor will I be," he said hoarsely. "I have no children. I believe in you. I have faith in you. Some day you will be famous. I can see that I will leave you the money I have so that you can pursue your life's ambition, if you will agree to take the name of Gye."

And so it happened. One day, not very much later, while Bullock was still down at the station dividing his time between his duties and



J. E. Bernard, London hatter, whose experiments with microscopes helped isolate the cancer germ, a problem that had baffled the wisest scientists for at least 6000 years.

his books, the old man died. And the invalid mother died of cancer. Young Bill Bullock resigned his job and, taking the name of his patron, as William Ewart Gye set his face toward his future.

Before long, Gye (the erstwhile Bul-

**The  
Hatter  
Who Rode  
a Hobby  
to Fame**



**The Boy Whose Dream Came True**

Dr. William E. Gye, who started life as William Bullock, ambitious railway porter. He got his chance by taking an old man's name. Now he has made it famous by isolating the long sought cancer germ.

lock) found the path he was seeking and, as a promising student of medicine was enrolled at Edinburgh University. There he sat under the brilliant Bennett, an expert on cancer, the dread scourge of humanity, which for 6000 known years had defied investigation. Gye began to study this unrelenting disease that had sent his mother to an agonizing death.

**G**YE worked hard and long. For a time his labors were interrupted, for war came and every true Briton did his bit. He was attached to an ambulance train and made studies of gas gangrene that were of inestimable scientific value. But this was only an interlude. No sooner was the war over than Gye went back to his cancer studies.

Incessantly he worked. For two years he did not rest from his researches except to sleep and eat. Christmas Day saw him hard at work in his laboratory. He made thousands of experiments with one aim, the isolation of the cancer virus. Many times when success seemed only a step ahead, he was compelled to begin all over again.

Finally he came up against a stone wall. He was satisfied that cancer is caused by a germ that enters the body from without, but he was unable to isolate the germ.

He tried filtration, but the germs were so small they could not be taken out of a liquid by the finest filter. He tried catching them under a microscope,

### **Brings Hope to Thousands**

**C**ANCER, spreading rapidly, has been threatening recently to take first place in the list of diseases that kill human beings. Nearly 100,000 persons died of it in the United States last year. It is a horrible scourge, killing with slow torture, practically hopeless when beyond the reach of surgery.

And now, with the isolation of the cancer germ, comes hope that this fearful, mysterious enemy of mankind may be conquered at last. Mr. Vischer's story of this tremendous scientific achievement, as told here, reads like a page from an Arabian Night's tale.



but the finest microscope he had ever heard of—instruments that magnified 1500 times—would not reveal them.

Gye was stumped.

Now, as so often happens in life, chance enters. The long arm of coincidence, so much longer in real life than any fictionist would dare make it, begins to reach out. It happened that a hatter in Jermyn Street, one J. E. Barnard, head of the firm of William Barnard & Sons, Hatters, had a hobby. By all the rote of successful business life and the usual aspirations of a shopkeeper, he was as mad a hatter as the hatter Alice met in Wonderland. Instead of hurrying to a golf course when the day's work was done, or to a card club, or to the races—which anybody could have told him was the proper thing for a hatter with an income to do—he went home and amused himself with microscopes.

AFTER a while Barnard, the hatter, became known among British scientists as a willing amateur who knew more than a little about lenses. Then Barnard, the hatter, came to be known among British scientists as the man who knew more about lenses than any one in the British Isles. The British Medical Research Council started its great cancer research at Hampstead and nearly every day Barnard, the hatter, after his new stock of bowlers had been arranged and the day's receipts had been counted up, hid himself to the Hampstead laboratories to experiment with new lights for microscopy that might impress on a photographic plate things invisible to the eye.

By ordinary light rays, about 550 millionths of a millimeter in length, magnification 1500 times is possible. But Barnard knew that by shorter light rays, by ultra-violet rays only 275 millionths long, he would be able to magnify 3000 times, even though he wouldn't be able to see the result. So he experimented with the invention of a group of German scientists at Jena, first announced in 1904, by which lenses of pure quartz were used instead of glass. The ultra-violet light was provided by an electric spark's jumping between two little points of cadmium. And photographic plates were used to catch the invisible light coming up through the lenses with the picture.

IT WAS inevitable that Gye, the one-time railway porter with an ambition, should some day meet Barnard, the hatter with a hobby. When Gye confided to friends that he could go no further with his researches unless he could find a more powerful microscope, it was only a matter of time until some one would say to him that he would have to meet Barnard.

The two met.

"I've got to catch these viruses under a microscope if my experiments are to succeed," said Gye to Barnard. "Can you do it for me?"

"I'll try," said Barnard.

The two worked together steadily and patiently. Gye was constantly at it. Barnard hurried over from Jermyn Street just as soon as his business would free him. Together they conducted countless experiments. They hoped in time to get a picture of 50,000 or perhaps even 100,000 of the cancer germs in a group. That would have been an unprecedented achievement, for it would have made

theory into fact and would have provided a foundation from which to fight and eventually defeat one of the three worst of earth's scourges.

They worked quietly and unostentatiously. Time and again cures for cancer have been announced and time and again the hearts of men and women have been buoyed up with hope, then cruelly twisted, because the report of a cure was false. Gye and Barnard wanted to make no such mistake. Furthermore, they knew that with the isolation of the virus the battle would be only half won. A cure must be found later.

So they kept at it. And finally, one



Cancer Tests with Chicks

Doctor Gye inoculating a young chick with the cancer virus. His experiments showed that the cancer germ produced a malignant growth only when introduced into the victim with germ-free extracts of tumors.

day, Barnard, with quivering hand, turned over to Gye a microphotograph. Gye took it and held it to the light. There was something never before seen by man, something that no eye could ever see, even with the most powerful microscopes—a photograph of a single round organism enticed into visibility by rays of light too thin for sight to catch. Not 50,000 in a conglomerate mass, mind you, but a single round cell—a cancer germ!

"I think we've got it this time," said Gye to Barnard.

And the two hurried on with their work.

SOME weeks later a crowd gathered in a street outside the office of the *Lancet*, an English medical journal. At first it was just such an indescribable gathering as happens hundreds of times a day, for no particular reason, in New York, or Chicago, or San Francisco. But this crowd swelled minute by minute, until it bulged through the Strand and disrupted the normal traffic of the street. It was not a joyous crowd, nor yet an angry one, nor yet one merely inquisitive. It was quiet and patient, throbbing with a deep excitement.

The event that drew the great crowd

was an announcement by the *Lancet* that the germ of cancer had been isolated by Dr. W. E. Gye, once a railway porter, and J. E. Barnard, a prosperous hatter. While the announcement made it plain that the discovery was in no way a cure for cancer, yet it was hailed instantly by scientists throughout the world as one of the greatest medical achievements in history.

FOR in tracing the cause of cancer to a germ, the discoverers laid bare a mystery that has baffled physicians for generations. By providing definite knowledge they paved the way for direct attack on this most dreaded scourge. And they gave science effective new weapons for striking at the root of other diseases.

Scientists point out that, as with other diseases, the discovery of the cause is just the beginning in the fight to wipe out cancer. How soon it can be conquered, no one can say. In the case of malaria, for example, the enemy went down easily, once it had been located.

Research workers gradually discovered that malaria was caused by a germ introduced into the blood by a certain type of mosquito. They knew, therefore, that if the mosquito could be prevented from biting men, malaria could be prevented. Other scientists took up the fight, attacking the mosquito in its breeding-grounds and making malarial districts healthy.

In the case of diabetes the fight was more stubborn, yet a cure was found at last in the discovery of insulin. But in the war against tuberculosis, although the position of the enemy long has been known, and although its death toll has been greatly lessened, today there is no known cure other than that of strengthening the body to resist the germs' attack.

In discovering the cancer germ Gye and Barnard reconciled two hitherto conflicting theories of cancer. One theory, commonly held by authorities, was that the disease was due to some change in the body by which unhealthy cells at a bruised point were converted into malignant cells. The other was that cancer was due to a germ entering the body from without.

In experiments with chickens, rats, and mice, Doctor Gye found that both theories were right—that cancer is caused by a germ, but that the germ is able to grow only in unhealthy cells.

THIS fact Doctor Gye demonstrated by inoculation of mice. Introduced by itself, the cancer germ was powerless, he found. Only by introducing both the germ and germ-free extracts of tumors was he able to grow cancers in mice.

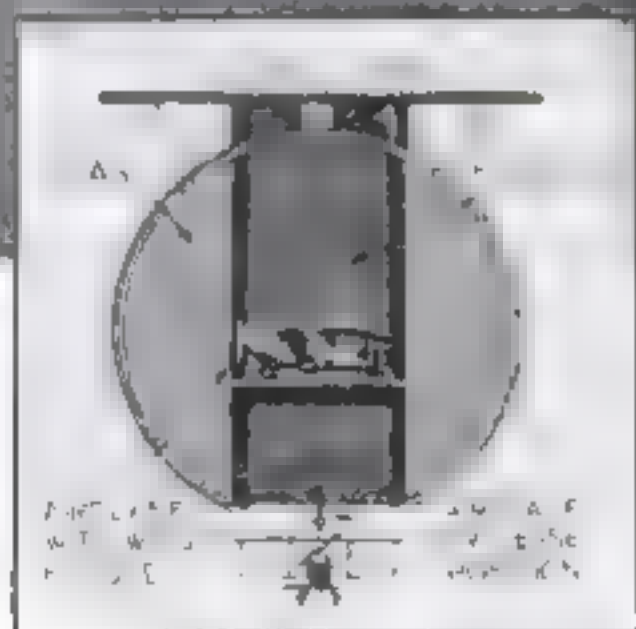
With the cancer germ isolated, Doctor Gye and his colleagues in the British Medical Research Council now are busy with experiments to develop a cancer vaccine that will make it impossible for the germ to secure a foothold in the body. In the Hampstead laboratories, definite success has been reported in making chickens, rats, and mice immune to the disease by inoculating them with a serum made from the newly discovered virus.

The perfection of human inoculation against cancer, of course, will not be a cure for the disease already contracted, yet scientists hold out the hope that soon it may furnish the basis for a preventive campaign to eradicate this curse of man from the face of the earth.



# A Giant Mother of Airplanes

*Dirigible to Act as a Hangar for Fleet of Smaller Craft*



ONE of the most daring ideas in aeronautics recently was proposed in England. It is that a dirigible should be built a hundred times larger than any now known, capable of carrying a small fleet of airplanes. As shown in the illustration, it will be at least three times the size of the largest dirigible now in use.

The dirigible, after it has been launched, receives a radio message asking for a

plane, and it starts a flying post office. A plane is wheeled into the central runway until it reaches the release chamber, and with a slight push for movement of engine and wings, the plane is launched. Remaining, the plane lands on the broad, flat top deck of the dirigible, where it is received by the elevator and restored to the hangar deck, where it is entirely overhauled.



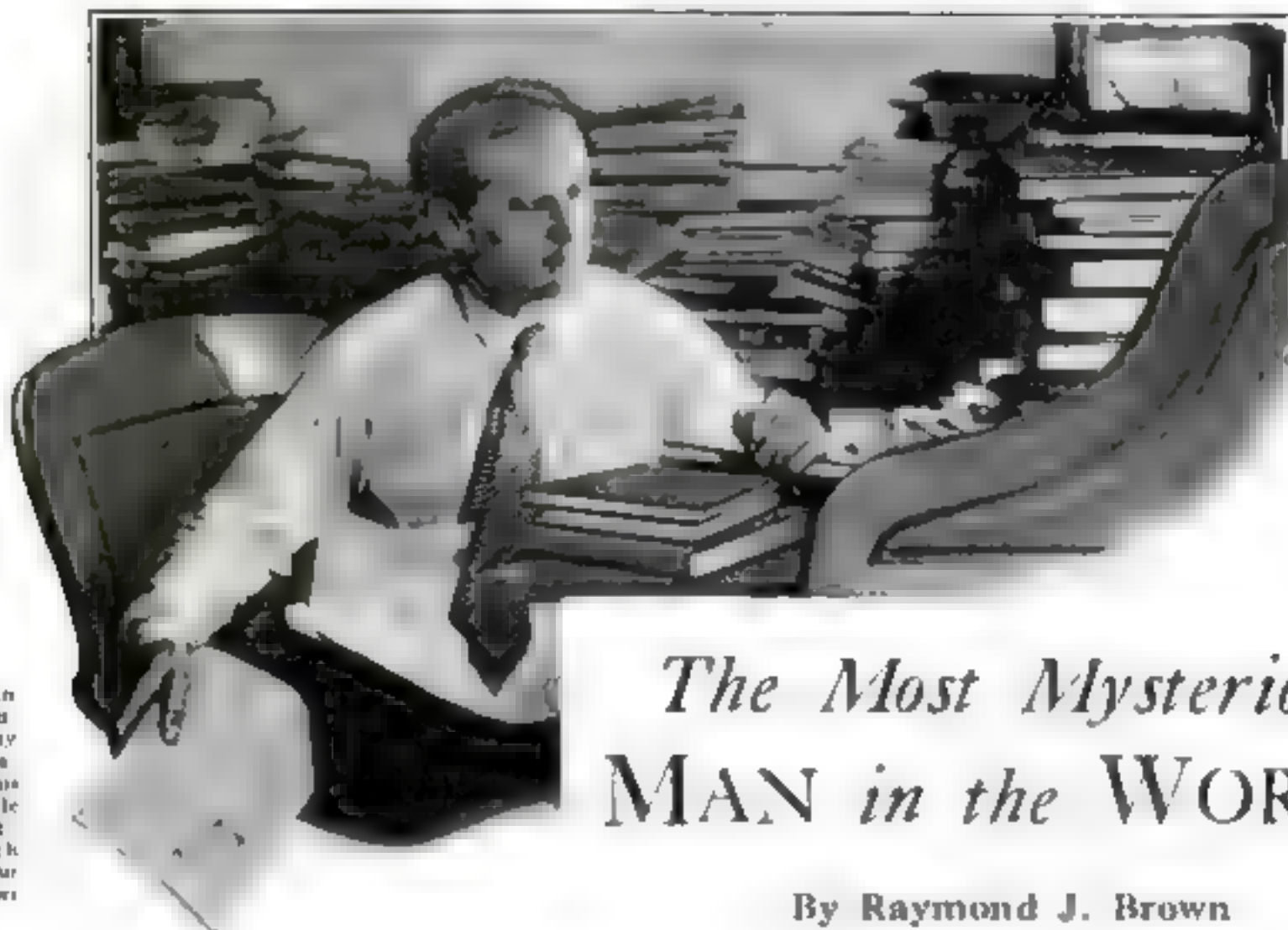
AIRPLANE ELEVATOR  
RELEASE CHAMBER

HANGAR

Cut-away view, showing interior of the giant dirigible that will carry small airplanes for scouting or mail service



# HOUDINI —



Houdini in his study surrounded by his books preparing his remarkable series of articles which begins in our next number.

## *The Most Mysterious* **MAN in the WORLD**

By Raymond J. Brown

I HAD seen Houdini on the stage—many times. I saw him first 20 years or more ago, when he was known as the "Handcuff King," and was exhibiting his astonishing ability to escape from shackles, ropes, chains, strait-jackets, locked trunks, and a variety of other bonds and entanglements.

I had seen him in more recent years cause a five-ton elephant to disappear from the stage. I had seen him shackled and thrust head first into a metal cylinder filled with water, over which a tight-fitting cover was padlocked. There seemed no possible escape for him from this dreadful contrivance; yet, only a second, it seemed, after the big can was screened by a curtain, he emerged, dripping and breathless, the shackles in his hand and a smile on his face.

I had seen him perform his famous needle trick in which he swallows four or five packages of needles and many yards of thread, and then has a member of the audience pull all from his mouth—with every needle threaded! I had seen his amusing but highly instructive and useful exposure of the tricks of fraudulent spiritualistic mediums.

But my greatest surprise from this master conjurer was reserved for a few weeks ago when I visited Houdini at his home in New York City. I found Houdini the man a more extraordinary personage even than Houdini the magician!

Houdini the magician—the man known to the public—is a professional trickster, an expert showman; spectacular, theatrical, practised in every artifice and device of the public entertainer. Houdini the

man, though, is a student and scientist, who prefers his library, stocked with a quarter of a million dollars' worth of books, on every conceivable subject, to any other place on earth.

He is master of six languages, and is versed in the literature produced by the greatest thinkers in all six tongues. He has profound knowledge, both practical and theoretical, of the natural sciences. He handles mechanics' tools and the delicate apparatus of the physical and chemical laboratory with the deftness of a specialist. He is an author, a psychologist, an anatomist, an inventor, a brilliant talker, a world traveler.

He has known the greatest men of his time and in these contacts has contributed quite as much as he has taken away. He is an athlete, who by training and self-denial has kept to middle life the lithe, powerful body necessary to the performance of his amazing feats. He is a business man, whose shrewd investments have made him one of the wealthiest men of the theatrical world.

AND it is Houdini the man who dominates Houdini the magician. As Houdini himself expresses it, "I could make a fortune every year on the stage—if I wished to."

Houdini the man, however, will not permit this. For five months each year Houdini the magician appears before the public; the other seven months belong to Houdini the man. Then it is that Houdini immures himself in his library to read, study, write, and to invent.

It may seem surprising that one whose

chief fame has come from dexterity of hand and strength of body should possess so remarkable a passion for pursuits of the mind. Actually, though, there is nothing surprising about it; for Houdini was a scholar and a teacher long before he became a magician. The son of a clergyman and educator, he was reared in a scholastic atmosphere, and almost before he was out of knee pants, he taught modern and ancient languages in the school his father conducted in Wisconsin.

"Books were my hobby, even as a child," he told me. "I read almost every book in the Milwaukee Public Library before I was 15. My reading was not systematic. It made no difference to me whether they were fairy tales, textbooks, philosophic essays, poetry, or romantic fiction. Some of the books I didn't understand—but I read them just the same. I believed, you see, that my life work would be teaching, so I wanted to learn everything I could about every possible subject."

"It's rather strange, isn't it, that a book-lover should take up such an unusual profession as magic?" I suggested.

"I went into magic more or less suddenly and by accident," Houdini said. "When I was about 15 I was attending a magician's performance with some friends. I hadn't studied magic particularly at the time; yet I wasn't mystified at all. Each time the magician would complete a trick, I'd tell my friends, 'I know how he does that,' and at last they got tired of hearing me say it. 'Well, if you're so darned smart,' one of them said, 'why don't



you go on the stage and do those tricks yourself?" "All right," I said; "I will." And I did.

"That was more than 35 years ago," continued Houdini reminiscently, "and I've been at it ever since. I made up my mind at the beginning, though, that if I was going to be a magician, I was going to be a good one. There seemed only one way to make sure of that, and that was by devising my own tricks—tricks that no one had ever seen before.

"My habit of reading stood me in good stead. I bought every book on magic that I could find, taught myself to do every trick that was described—and then discarded them all and invented original tricks and constructed with my own hands the apparatus necessary to perform them. And I've been doing that ever since. Every illusion I ever have performed has been conceived, constructed, and executed by me alone. And not one of them," he added after a moment, "ever has been correctly explained. I have performed them before millions of people. I have performed them privately before professional magicians; and they are still secrets—mysteries—known to me alone.

"One of the greatest thrills I've ever had came when I was a young performer and it was reported to me that Kellar, dean of American magicians, was saying to his interested and puzzled audiences.

"Don't be ashamed if I mystify you. I have seen Houdini's work, and I have no idea how he produces his effects."

"Do you intend ever to explain how you produce your effects?" I ventured.

"Certainly," Houdini answered. "I'll explain to you right now. I produce my effects by natural, physical means; by utilizing well-known laws of science and mechanics for the purpose of mystifying. I have no occult powers. I can no more tell you what you are thinking about at this moment than I can cause those buildings opposite us to collapse by waving my hand.

"I cannot transfer my thoughts to another person's mind except through some recognized form of communication. I cannot bring back the spirit of one who has departed. If you were to lock me in this room, I could not escape except by means of a key, violence, or the employment of the purely physical skill I have acquired at escaping from restraint. However, by trickery I can make it appear that I am able to read your mind, to transfer my thoughts, to establish communication with the dead and so on."

Houdini excused himself for a moment and returned with a blank slate. We sat at opposite sides of a small



The Modern Aladdin

Never has there been made a pair of handcuffs from which Houdini could not quickly escape by his mystifying and skillful magic.

table, and he thrust the slate beneath it and requested me to take hold of it. An instant later there came a scratching sound from under the table. When this ceased, Houdini released his hold on the slate and bade me raise it and look at it. The slate contained my name, home

address, and home telephone number, written in chalk!

"Mystifying, isn't it?" inquired Houdini, laughing at my expression of astonishment. "You'd almost believe me, wouldn't you, if I told you a spirit wrote that? Well, I'm the spirit that did it.

"Look here," he directed, thrusting his hand beneath the table and drawing out a second slate. "This," he said, "is the slate you saw me bring into the room. The slate you have in your hands was under that table for several hours—message and all. I wrote that message when you phoned me that you were coming here. It was an easy matter for me to get your home address and telephone number from the directories when I knew your name and occupation. When I asked you to hold the slate with me under the table, I made a 'switch,' handing you the prepared slate, which I released from a clamp that held it against the under side of the table and placing the blank slate in the clamp. The writing sound you heard I made with my finger nail on the surface of the blank slate.

"That, of course, is a very simple trick; yet through it I probably could have convinced you that I was a mind reader, a medium, and what not. Just a moment, and I'll show you something even more astonishing. Write a message on that blank slate, and let me see it."

The message I wrote was

"Houdini is the most mysterious man in the world."

"Thanks," smiled Houdini as he read it. "I hope I deserve the compliment. Now turn the slate face down, and don't let any one see it."

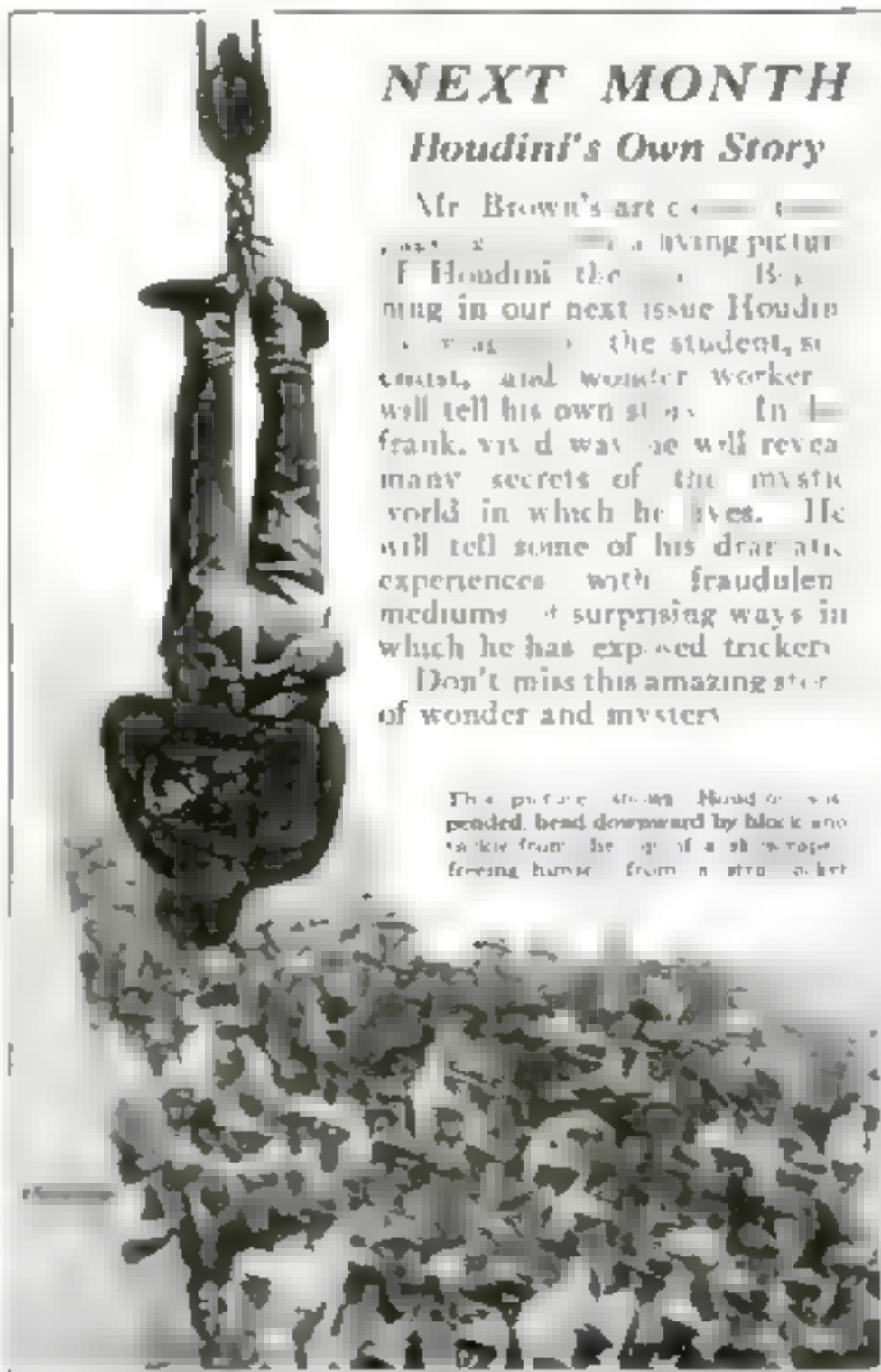
He walked to the door, and called upstairs, requesting Mrs. Houdini to join us. When she came in, her husband presented me to her, the three of us exchanging the polite commonplaces that are customary on such occasions. Not once that I could notice did Houdini make a signal or utter anything beyond the conventional remarks incidental to introducing a guest in his home to his wife; yet not more than 20 seconds after she had entered the room, Mrs. Houdini turned to me, smiled, and said

"You wrote on that slate, 'Houdini is the most mysterious man in the world.'"

"How on earth did you tell her that?" I demanded of Houdini after his wife had departed.

"By natural, physical means," he replied. "Mrs. Houdini and I used to do a mind-reading act, and have a secret code of communication—made up entirely of natural gestures, words, and so on—which permits us to exchange the most complicated messages in the presence of others without detection.

(Continued on page 25-1)



## NEXT MONTH Houdini's Own Story

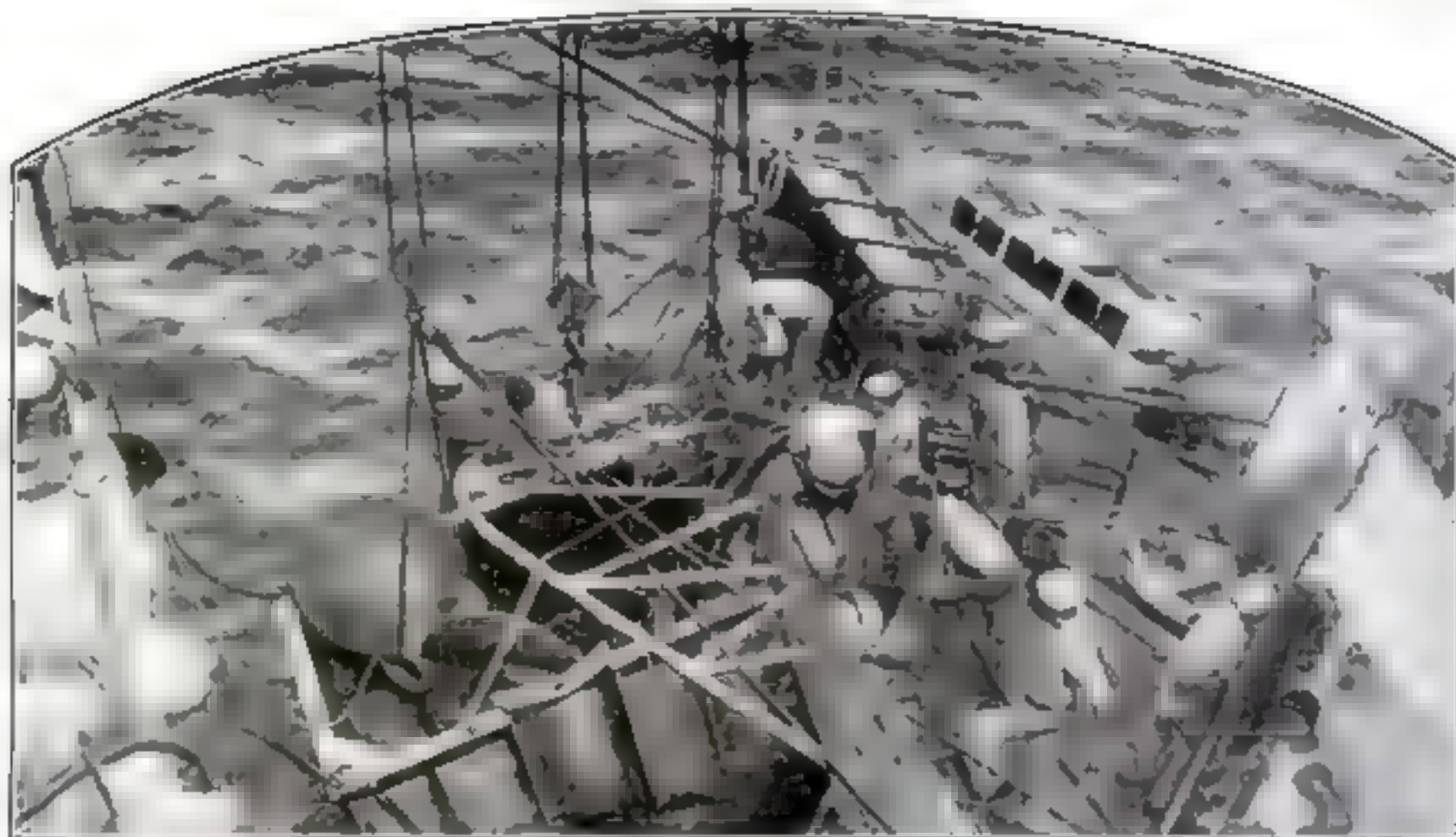
Mr. Brown's article

... a living picture of Houdini the ... in our next issue Houdini ... the student, scientist, and wonder worker will tell his own story. In a frank, vivid way he will reveal many secrets of the magic world in which he lives. He will tell some of his dramatic experiences with fraudulent mediums and surprising ways in which he has exposed trickery.

Don't miss this amazing story of wonder and mystery.

This picture shows Houdini suspended, head downward by black and white from the top of a gallows, freeing himself from a strait jacket.





Lowering Away the Floating Caisson

Repair ship standing by U. S. S. *McCormick* (left) to replace damaged propeller weighing 6500 pounds. This remarkable feat was performed in the Pacific Ocean by means of a floating caisson and sailor-divers.

## Uncle Sam's Cruising Repair Shop

### *Destroyer's Broken Propeller Ingeniously Replaced in Mid-ocean*

**D**URING the recent naval maneuvers in the Pacific, there was performed on the destroyer *McCormick* one of the rarest and most difficult operations of modern seamanship—changing a damaged propeller while on the high seas.

In 4½ hours the old propeller had been removed, a new one put in its place, and the destroyer was ready to proceed on its way. This extraordinary feat was made possible by a special type of caisson invented recently by Lieut. William O'Neill at the Philadelphia Navy Yard.

Damage to propellers is not infrequent among the smaller vessels of the navy. Constant vibration sometimes causes a propeller to crystallize and throw one of its blades. Or one or more of the blades may be clipped off by striking a submerged rock or bit of wreckage. Even if the blades are not broken, if one is badly bent, the resulting vibration to the vessel is so tremendous that the destroyer cannot make good speed and the propeller must be replaced.

On both the Atlantic and Pacific oceans there are cruising repair ships for both destroyers and battleships. If one of these happens to be within radio-calling distance, it will bring a new propeller and caisson and the work can be done on the open sea.

It would be possible for a ship to make its own repairs if it had the equipment, but extra propellers weighing many tons and the caisson needed for the work,

weighing about 2½ tons, would be decidedly in the way on a destroyer.

The repair ship draws up alongside the destroyer and lowers the caisson at the stern of the destroyer by means of leading and guy wires. The caisson is about 12 feet deep and long enough to contain the propeller and a short section of the propeller shaft.

The submerged caisson slips up under the propeller from the stern and is brought up so that the upper edge is about three

feet out of water. The propeller shaft slips halfway down the box in a slot that curves at the bottom to fit the shaft. After the box is in position, a door slides down the slot, filling the opening. The bottom of the door is curved, fitting the upper part of the shaft.

A diver then descends into the box and calks the crack between the shaft, caisson, and door, so that the box becomes watertight. Every destroyer carries diving equipment and at least one or more seamen gunners trained as divers. Divers are needed to free anchors or recover torpedoes that have been shot into the mud and that may be used again. The diver passes a line about the latter and they are drawn back to the ship.

All the water is pumped out of the caisson, and one or two men remove the damaged propeller. A nut and locknut hold the propeller on the shaft. These are covered with a pointed cap of light metal. These parts are removed by means of a sledge hammer and iron bar and the propeller is driven off. The weight of the propeller is supported by a line from the repair ship.

It is easier to slip the new propeller into place than to remove the damaged one. Some destroyer propellers are not welded in one piece, but have separate blades. In such cases it is necessary only to replace the blades that have been damaged. One of the propellers changed on the *McCormick* weighed 6500 pounds.

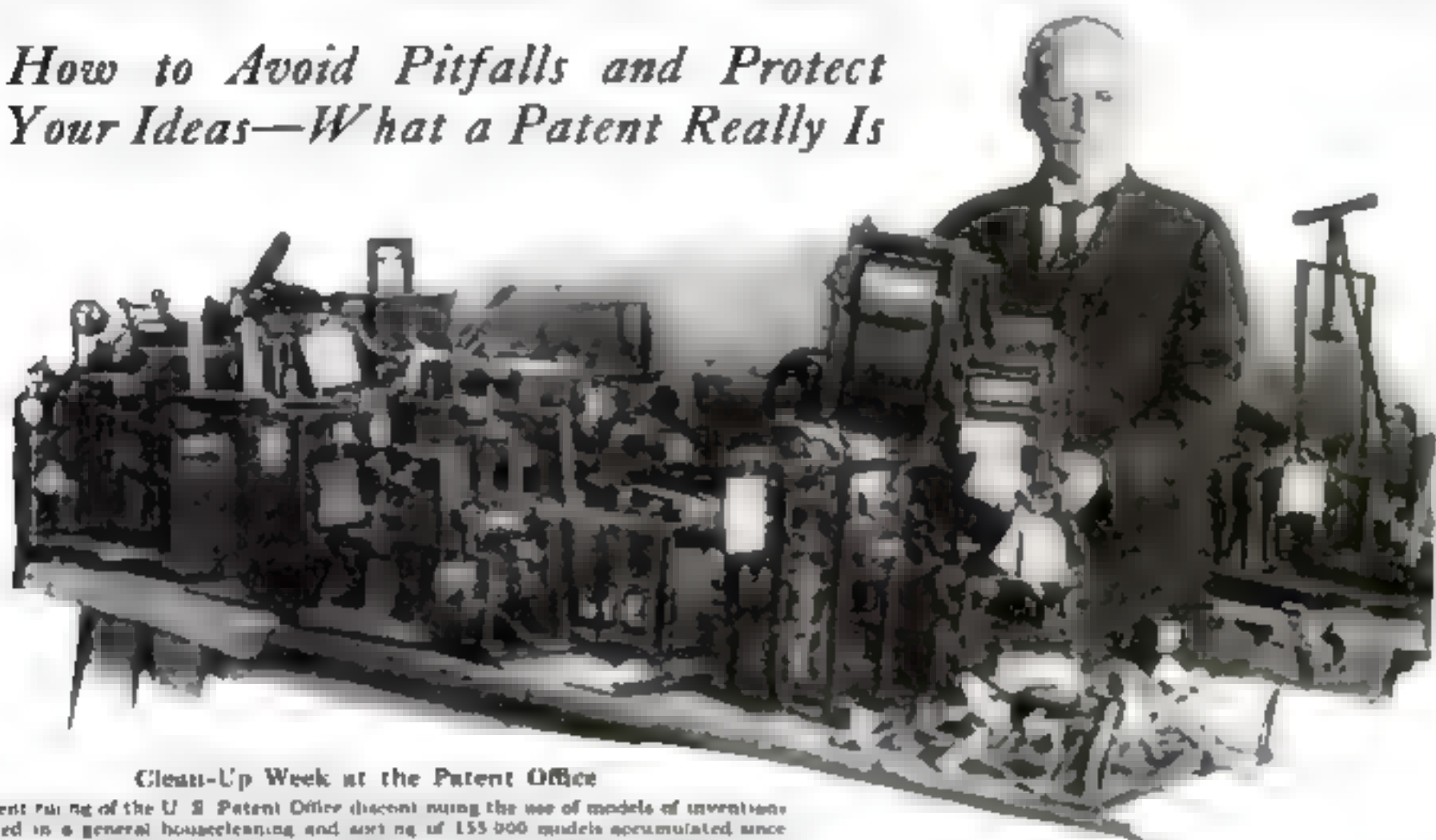


How the caisson is adjusted to propeller shaft by a sliding slot that is tightly calked until new propeller is in place



# Some Snares for Inventors

*How to Avoid Pitfalls and Protect Your Ideas—What a Patent Really Is*



Clean-Up Week at the Patent Office

A recent ruling of the U. S. Patent Office disconting the use of models of inventions resulted in a general housecleaning and sorting up of 155,000 models accumulated since 1884. Patent Commissioner Thomas P. Robertson is shown above with a few of them.

By Frank Parker Stockbridge

WITH "blood in his eye," a man walked into the office of a famous patent attorney. His hands indicated that he was a mechanic, his clothing, that he had "dressed up" for the occasion.

"See this advertisement of the sky-high carburetor?" he demanded. "I've got a patent on that, and I want you to sue 'em for me for a million dollars. Here's the official copy of my patent—June 18, 1920, to John P. Smith." I'm Smith."

The attorney studied the advertisement, taken from an engineering periodical, which showed a detail drawing of the sky-high carburetor. Then he looked over the patent papers.

"Just where do you claim there is an infringement, Mr. Smith?" he asked at last.

"Why, in the method of controlling the air supply," replied his visitor. "See the way they show it in their picture? Now that's just the way it is in my patent."

The attorney studied the patent papers again, but his attention was fixed on the printed text instead of on the drawing.

"I don't find anything in your claims covering this method of air control," he said finally. "If this is all you have, Mr. Smith, I'm afraid you haven't much chance to collect that million."

Smith turned pale. "But—but it was in my application, all right," he stammered. "That's my whole invention—all these other things are just details. And it shows right there on the drawing. Do you mean to tell me my patent's no good?"

"It's a good patent, as far as it goes," the attorney answered; "but it doesn't go far enough. Didn't your original attorney advise you that your application had been amended?"

"Why, I did have some letters from him, but I don't remember now what was in them," the visitor admitted. He felt worried, promising to bring all the correspondence.

What Smith thought he had invented and received a patent for wasn't what his patent described at all," said the attorney, telling me of this incident. "Among the papers he brought me was a letter from his former attorney, telling him that the claim in the original application covering a method of air control had been disallowed by the Patent Office on the ground that it was old. He could use it, if he wanted to, but so could the sky-high people or any other manufacturers of carburetors. It showed on his drawing, because it helped demonstrate the action of his actual inventions, which were patentable, but not of any particular commercial value, since the same results could be accomplished more simply in other ways."

SMITH had fallen into one of the pitfalls with which the way of inventors is beset. He did not read his patent claims, but took it for granted that they covered what he thought they covered. In this country a patent covers nothing but what is set forth in the claims allowed, and there is no way to correct a mistake in the claims but to apply for a reissue. In England and on the Continent a court in which the validity of a patent is challenged will take judicial notice of the inventor's intention.

No matter what you have invented, if it isn't described in your patent claims, you haven't got a patent on it."

Failure to recognize this important factor cost Renaud, the French inventor

of the automobile gear-shifting mechanism now universally used (except on Ford cars), the enormous fortune he could have collected in royalties from American automobile manufacturers.

"WHAT good is a patent anyway?" I asked another attorney who had been practicing before the Patent Office for 30 years.

"If you've got a good invention, a patent is a protection—until somebody else proves that he invented it before you did," he said. "A patent has been described as 'a license to sue and to be sued.' If your invention is good, somebody else is going to claim that he saw it first. And if he can make that claim good, you're sunk."

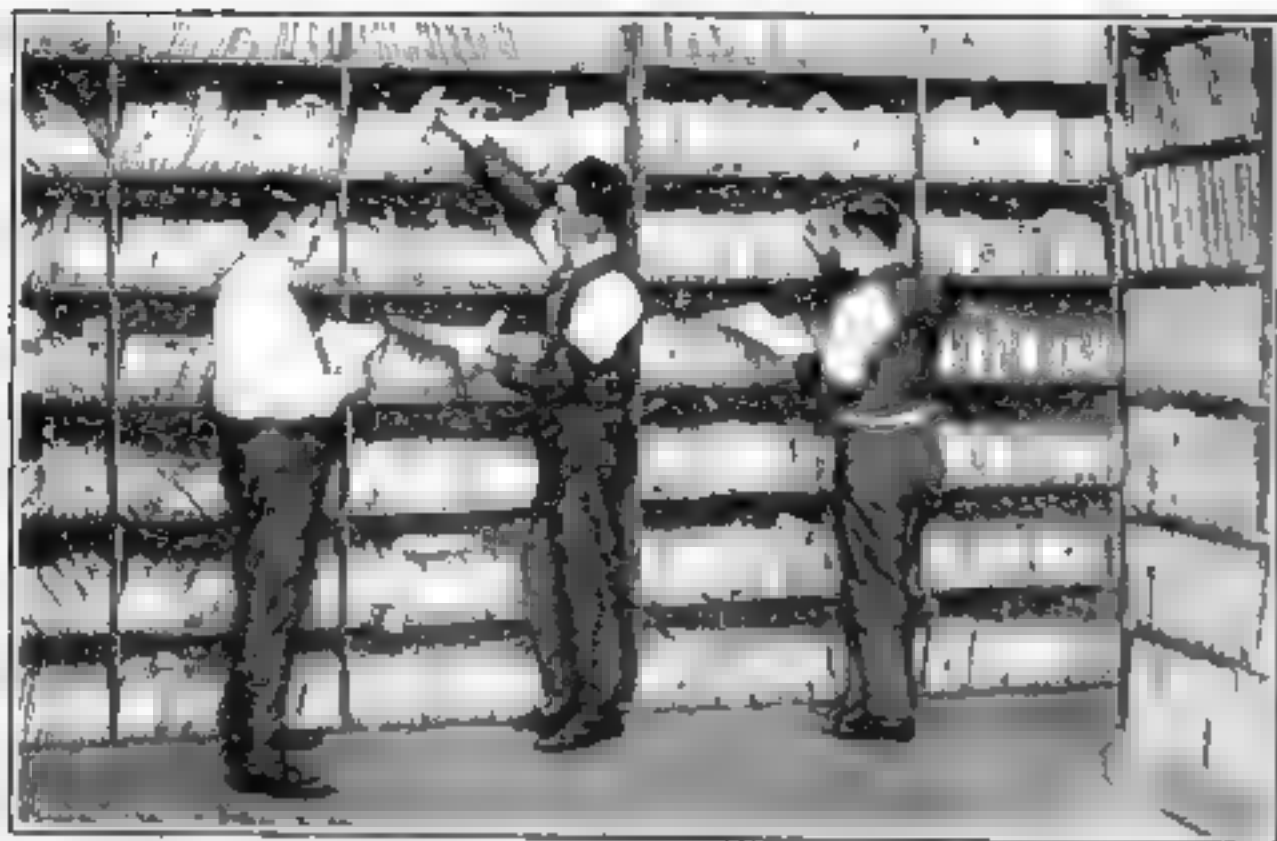
"Most inventors make the mistake of thinking that a patent is a guarantee that their invention is valuable. It isn't anything of the kind. Of every 1000 patents issued, 900 are without commercial value."

"Then what does a patent prove, anyway?" I pursued.

"It proves only that the specific thing described in the patent claims has not been done or described in that precise way before, so far as the Patent Office experts know or can find out," was his answer.

IT SOMETIMES happens that a valuable invention is not patentable because it has been described in print so that any one could do the same thing. That happened when Morgan Robertson, writer of sea stories, applied for a patent on the submarine periscope. Mr. Robertson went one day with Lewis Nixon, shipbuilder, who was constructing the first Holland submarines for the navy, to see the new craft. "We've been trying to work out a scheme whereby the captain can see where he is going without coming to the surface,"





### The Storehouse for 1,500,000 Ideas

Nearly a million and a half patents are contained in the vast files of the U. S. Patent Office, which issues about 40,000 annually.

said Mr. Nixon. Mr. Robertson immediately suggested a telescoping tube with mirrors set at the proper angles, that could be shoved up to the surface when the submarine was submerged—practically the periscope, now an essential part of every submarine's equipment.

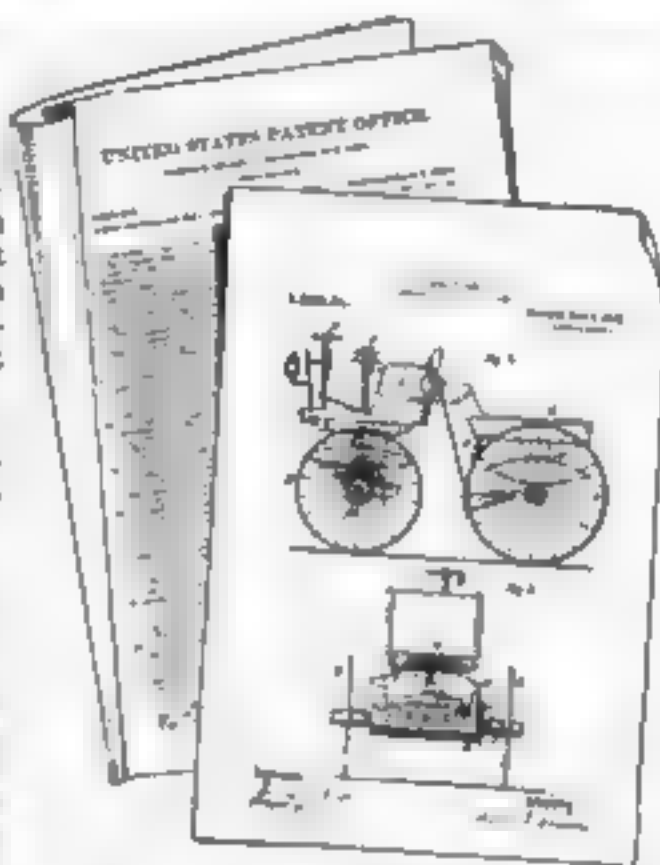
"You've got it!" Mr. Nixon exclaimed. "I'll have one made and we'll get it patented in your name and we'll pay you so much for every one made."

**ROBERTSON** saw a fortune coming his way; but at the Patent Office, the examiners turned to a copy of Jules Verne's "Twenty Thousand Leagues under the Sea," published years earlier, in which an entirely mythical submarine was equipped with an equally mythical periscope, worked just as Robertson had imagined it. The description was so detailed that the device was obvious, the Patent Office held.

The same sort of an objection was raised in the case of the balloon tire patent recently issued to an inventor after balloon tires had been in use for several years and their principle had been discussed in print for years before. In this case, however, the Patent Office held that the invention was not obvious from the articles that had been published; and of course the application had been filed long before the first balloon tire was made.

Many inventors have lost fortunes by neglecting to make any records of the dates when the inventions first took shape in their minds. A simple sketch or a brief written description, dated, signed, and witnessed by one or two friends, may establish a claim to priority when somebody else claims to have invented the same thing before the patent application was filed.

It is not at all unusual for two or more persons to invent the same thing about the same time. Where two or more persons have applications pending for patents covering the same ground, the one who can produce proof of the earliest date of invention gets the patent. Often, however, after a patent is granted, it is challenged on the ground that the same



### A Historic Patent

One of the most widely heralded patent suits was that which cost G. B. Selden half a million dollars and the loss of royalties on the sole inventor of the gasoline "road engine." A copy of a renewal of the original Selden patent with drawings is pictured above.

thing was being done in industry before the inventor's application was filed. Then proof often is not easy to get.

**MANY** years ago a man named Smith died in Buffalo, N. Y. He had run a bicycle repair shop in Washington, D. C. His executors sold his business and all the assets were bought by another bicycle dealer named Owen. Included in the property were some patents. These Owen handed to his brother-in-law, a patent attorney, to look into. One of them was apparently a basic patent covering a method of hanging the bicycle crankshaft, the method then used by every American bicycle manufacturer, and still in use.

Suit for infringement was brought against some of the leading manufacturers, and they faced the likelihood of having to pay out a fortune for infringements of a patent, the existence of which they had not known. Then an

English mechanic, working in Boston, came forward with an English crank-hanger just like the patented article, and declared that he had brought it over from England with him a year before the date of Smith's patent application. Several of his fellow workmen made affidavits that they had seen the device in Smith's hands at that time. The manufacturers decided to defend the suits.

But Owen and his attorney were not discouraged easily. If they could find Mrs. Smith, she might know when the invention had been made. But Mrs. Smith had vanished. A search of the vital statistics in Buffalo resulted in finding that Smith had died at a boarding-house that had changed hands. The former landlady was discovered. She remembered that when Mr. Smith died, Mrs. Smith's married sister also lived in the house.

It took weeks to trace the married sister. Through her it was learned that Mrs. Smith had gone into a convent at Batavia. But she had the keys to a trunk, in which was found a signed, witnessed drawing of the crank-hanger, dated months earlier than the application for the patent.

**BUT** still there was that English device of an even earlier date, if the Boston mechanic's story was true. Owen's attorney suspected that the mechanic was lying. And, on the day when the case came up in court, the manufacturers' attorneys got a letter from the mechanic admitting that he had falsified the date of his arrival in America by a year and had bribed the other witnesses. The dated drawing proved that Smith had invented the device before the first recorded use of it anywhere, and the manufacturers pooled their interests and bought the patent from Owen for \$285,000.

A still greater fortune may be waiting for the inventor of the demountable automobile rim, now universally used, who lost his evidence of priority and couldn't find it for 16 years. His application was filed in 1907 and his patent granted in 1916. Its validity was questioned because such rims had been in general use for years and there was evidence that they had been thought of before 1907.

Somewhere, the inventor knew, he had a drawing and description, properly signed and witnessed, dated earlier than that earliest date on which anybody claimed to have any prior evidence. Where it was he could not remember.

Without written evidence of priority of invention the inventor could not sue to collect from everybody who had made and used demountable rims since his patent was applied for. Then, a few weeks ago, he found a perfect drawing, properly signed, witnessed, and dated!

In contrast to the inventor who loses because his claims are not sufficiently specific, one of the largest amounts ever involved in any litigation of a single patent was lost by the inventor because his claim was too specific! This was the famous Selden patent on the automobile. On the face of it, the Selden patent, issued in 1895, covered any kind of an automobile propelled by a gasoline engine. From 1901 every automobile manufac-

(Continued on page 160)



# This Woman Expresses Her Ideas with Anvil and Hammer



The Family Crest

John Held, Jr., designed this sign. Mrs. John made it in iron and John says it tells the family story

By Newton Burke

**A**LTHOUGH there may have been women blacksmiths in the past, it is unlikely that any female Vulcan of bygone days ever succeeded in combining mechanical skill in blacksmithing with a well-developed artistic sense in just the way this has been accomplished by Mrs. John Held, Jr., of Westport, Conn.

Mrs. Held, through her own amazing skill with hammer and anvil and with the assistance of her husband, a well-known artist and illustrator, literally has created a growing business out of nothing but ideas and sheet iron.

It all began, as do so many commercial enterprises, with a desire for something apparently not obtainable in the open market. Mrs. Held decided that there ought to be a sign on the gatepost of their farm. A painted sign would not do. Anybody could have a painted sign.

A family consultation was held to settle this important matter, and John Held, Jr., jokingly suggested that since she wanted something different, she might put up an electric sign!

"While we were still arguing," said Mrs. Held, "Mr. Held handed me a sketch with the remark that it illustrated a true state of affairs, as well as being individualistic."

"After considering about every possible way in which a sign could be made," she continued, "I decided to try my hand at making it out of one solid piece of iron. My previous experience had been limited to hammering brass and similar light metalwork. The first attempt got mired up so badly, I had to throw it in the scrap pile. The second was almost finished when a misdirected blow of the hammer broke off part of one of the figures. By that time I had acquired sufficient skill to do the work properly, and the third sign was a success."

"THE sign looked so well that I was encouraged to tackle other jobs, such as that fire screen, the standing lamp beside you, and those door hinges."



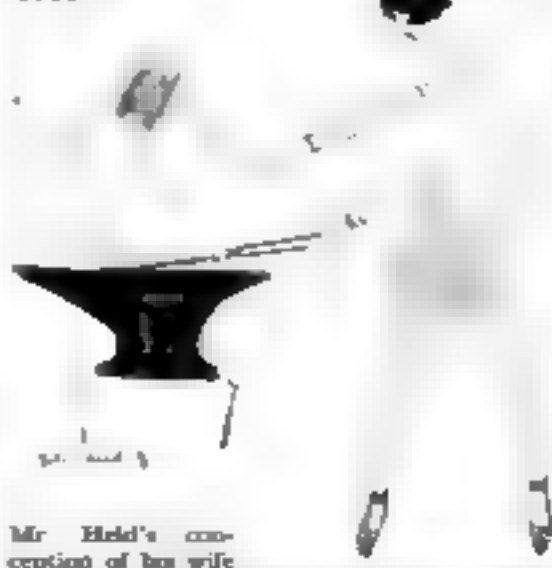
Mrs. John Held, Jr., before her Sample Board

Wife of a widely known artist, Mrs. Held at first wrought articles in iron for the decoration of her home. Enthusiastic friends told of her skill at the forge, and thus started a flourishing business

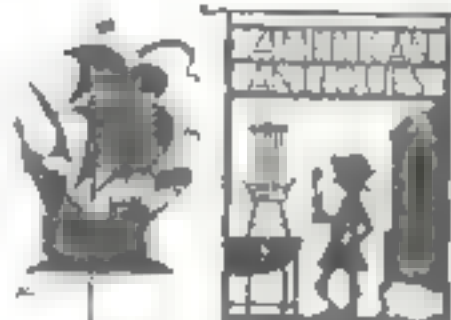
Mrs. Held is tall and willowy, so unlike the person I had imagined—a sort of sister to Longfellow's village blacksmith, "with large and sinewy hands, and the muscles of her brawny arms as strong as iron hands"—that I had to ask her about it.

"Blacksmithing is not so much a matter of muscle as it is of knowing how to apply

"Under the  
Spreading  
Tree"



Mr. Held's conception of his wife at work—a twentieth-century version of Longfellow's poem, "The Village Blacksmith"



Weather-Vane and Sign

Examples of ironwork made at Mrs. Held's forge. Each design is original and each is made by hand

what muscle you have in just the right way," replied Mrs. Held. "Of course, if I kept at it steadily, I suppose soon I could pose for one of those muscle-building advertisements."

"BUT, you see, I don't have to do that. At first, when our friends began asking me to make articles that can be made most artistically in wrought iron, I worked like a slave, but later I trained assistants to do the work my way."

"So now it has become a regular business?" I prompted.

"In a way it has," Mrs. Held answered; "that is, I have a regular staff of blacksmiths, who devote a good part of their time to making up the gate signs and

other things Mr. Held and I have designed, but the shop still is an old-fashioned blacksmith shop, where horses are shod and the usual country blacksmithing jobs take up some of the time. Of course, you understand that the work still is carried on by hand. No modern duplicating machinery is used, and every piece is necessarily just a little bit different from another, even when they both are produced from the same design."

"But hand work means high prices, and high prices, I should think, would scare many possible purchasers," I suggested.

"THAT'S true, but then you must remember that our gate signs ought to last for years and years. They are far more durable than signs made of wood and painted in the usual manner."

"The fact that they are so extremely durable has brought us a number of orders from towns and cities for signs to mark the intersections of streets. The kids can shy rocks at them until they wear out their arms without hurting the signs in the least."

Mrs. Held and her assistants can complete only about two signs a day. She is content to turn ideas and iron into useful and artistic objects, and to make a small profit while doing it.



# Science Mines the Ocean

By Edgar C. Wheeler

*Tons of Gold,  
Sunken Treasure,  
Rich Minerals,  
Huge Food Stores,  
and Lakes of Oil  
Challenge Man*



How Science Salvages Treasure

An expedition now is working to recover \$5,000,000 in gold from the steamship *Florida*, sunk off Virginia in 1911. A large hole is being cut alongside the strong-room, the door of which will be dynamited. Divers will load the treasure—weighing about 30 tons—into one-ton wicker baskets, which will be raised by strong pulleys

**F**IVE-SEVENTHS of the world's surface has never been explored. Hidden millions of mysteries have beckoned to man for centuries from this vast area covered by the waters of the oceans.

Now, however, spirited venturers in the fields of science are reading the secrets of the sea. They are finding, not only new methods of locating sunken treasure, but also how to prospect for new resources that can be turned to the use of mankind.

One scientist says he has found a way to sift pure gold from the salt waters. As an eager prospector would search among quartz hills, this scientist—Prof. Fritz Haber, of the University of Berlin—literally is following veins of gold, silver, and other precious metals running through the oceans. And in this venture he is enlisting the cooperation of the U. S. Bureau of Fisheries.

Gold! Thousands of millions of tons of it carried in the foaming surf that pounds the beach; tossed about in mountainous waves of mid-ocean; hidden in miles of watery depths.

**N**O SUCH staggering dream of wealth ever lured the hardy adventurers who staked their lives in the reckless gamble for fortune in the California hills or down the Yukon. It seems unreal, fantastic.

It has been found that water from the Atlantic Ocean contains from 015 to .267 part of gold to each million parts of liquid. Water from certain parts of the ocean contains nearly twice as much gold as the lowest grade land gold deposits profitable to operate.

Captain F. H. Bassett, hydrographer of the U. S. Navy, is authority for the recent statement that billions of tons of gold are dissolved in ocean waters in a concentration of from half a grain to one grain to every ton of water. This represents about \$10 worth of gold in every 250 to 500 tons of ocean waters.

Will the day come when we shall see great ocean mines where men will dip into miles of sea and extract from vast volumes of its waters the gold it conceals?

No one can answer these questions with certainty today. Nevertheless, Professor Haber's claims give us some inkling

of the fascinating chances of fortune in store for the modern prospector who digs down into mysteries of the unknown deep.

The vast expanses of water are saturated with valuable salts and minerals. And they literally are swarming with living things, both plants and animals, far outnumbering the life of the land. Lying beneath these myriad forms of life are great mountain ranges, volcanoes, valleys, and plains that form the floor of the sea. Strewn over this uneven floor, buried in shifting sands and held in the slime of dead things from above, are countless carcasses of wrecked ships that have gone to their doom laden with rich

Cognizant of these immense possi-

*Neptune Beckons  
Hardy Venturers  
to the Greatest  
Test of Human  
Ingenuity in the  
World's History*

bilities, Uncle Sam's Navy is embarking on a far-reaching program of ocean research. As a first step, the U.S.S. *Rainbow* is being fitted out for an expedition to the Gulf of Mexico and the Caribbean Sea. The announced purposes are to chart the ocean floor and to discover and develop for immediate use some of the sea's hidden resources.

**O**NE of the most fascinating efforts of the expedition is toward the location of oil fields in the vast realm under the great blanket of water. The navy already has located and charted places in the Gulf of Mexico where oil spots constantly appear. With the oil fields of the land nearing exhaustion, the economic importance of such a potential discovery is obvious.

Scientists have determined by study of land oil fields that the presence of fossils of small shell-like animals, called "foraminifera," is a highly accurate indication of oil-bearing strata. The *Rainbow* is equipped to study the geological formation of the sea bottom and to bring up samples of the fossils below the bottom at spots indicated on the charts.

The resources sought by the *Rainbow* include, beside oil and the myriad living things, vast stores of inorganic matter—salts, minerals, chemical elements. Whether the extraction of gold from ocean water by Professor Haber's process ever will prove commercially practical, there is no question that the sea is a tremendous potential commercial source of common salt, potassium, magnesium, and calcium salts, iodine, and bromine.

**A**T THIS moment one of the strangest ships afloat, the *Ellyl*, is mining the ocean for bromine, an element used in medicine, in photography, and in the manufacture of motor fuel. The *Ellyl* pumps aboard 7000 gallons of sea water a minute, and from each 1700 gallons is extracted one pound of bromine. Other ships, it is reported, will be equipped similarly to mine this valuable element.

Truly, there are fortunes locked in Neptune's vaults and the number of modern prospectors of the sea is increasing





### Mechanical "Ear" to Find Pirates' Gold

William J. Beebe, a Canadian, recently perfected a radio device with which he hopes to locate pirate treasure sunk off Cocos Island in the Pacific. Mr. Beebe is shown with his instrument and the 25-foot vessel in which he has embarked for the South Sea.

daly. Probably never before in history was there a "gold rush" so feverish as that which now is luring adventure-loving men away from solid ground.

Fortunes are gambled and lives are risked in hazardous attempts to retrieve millions in gold and jewels from the hulks of sunken ships. Wealthy men are spending other fortunes equipping expeditions to study the teeming sea life and the luxuriant vegetation miles below the sea's surface. Still others are searching the waters of the Mediterranean for the riches of cities that we engulfed centuries ago.

**M**ARVELOUS diving chambers have been devised to permit men to work and explore freely under the tremendous pressure in the deep caverns of the ocean. Undersea cameras now are available to record ocean wonders. Ingenious depth-finding apparatus is giving us accurate contour maps of the floor of the ocean. Radio is being employed in attempts to reveal the spots where sunken treasures are hidden.

With these elaborate tools, the ocean prospector is finding his field almost limitless. Just remember that five-sevenths of the earth is covered by the oceans and in the oceans are 302 millions of cubic miles of water!

In sunken ships alone fabulous rewards beckon the fortune-hunter. Recent inventions make this form of prospecting something more than a wild guess and a perilous plunge. Armored diving-suits and working chambers are making it possible to go down far beyond the 200-foot depth, formerly the limit of human endurance.

Improved deep-sea pumping apparatus also is making it possible to remove tons of sand with which Neptune holds many a treasure hulk in tight grip, and to wash

this sand for bits of precious metal, much as miners wash the sands of streams for grains of gold.

Within the next 10 years it is predicted, more wealth will be recovered from sunken ships than in all the preceding ages in the world's history.

Perhaps the achievement that did as much as anything to encourage the present stampede of ocean prospectors was the spectacular success of divers in recovering the \$30,000,000 cargo of

gold from the wreck of the *Lawrence*, sunk by a submarine off the coast of Ireland in 1917. Other ships of comparatively recent sinking have given up much of their treasure because science has found ways to reach depths never before attempted. Thousands more await the salvager.

**A**LONG our own Atlantic Coast lie at least a dozen of these wrecks with strong-rooms full of gold waiting the first comers. At this moment four young Americans are exploring what is probably the richest of these prizes—the wreck of the *Ward* liner



*Merida*, sunk in collision off the Virginia capes in 1911 with gold, silver, copper, and jewels worth from \$2,000,000 to \$5,000,000. Dragging a mile-long iron sweep along the floor of the ocean, the trawlers *Foam* and *Spray* located this prize several months ago. And now, using the most modern of armored undersea apparatus, divers are at work to recover the treasure.

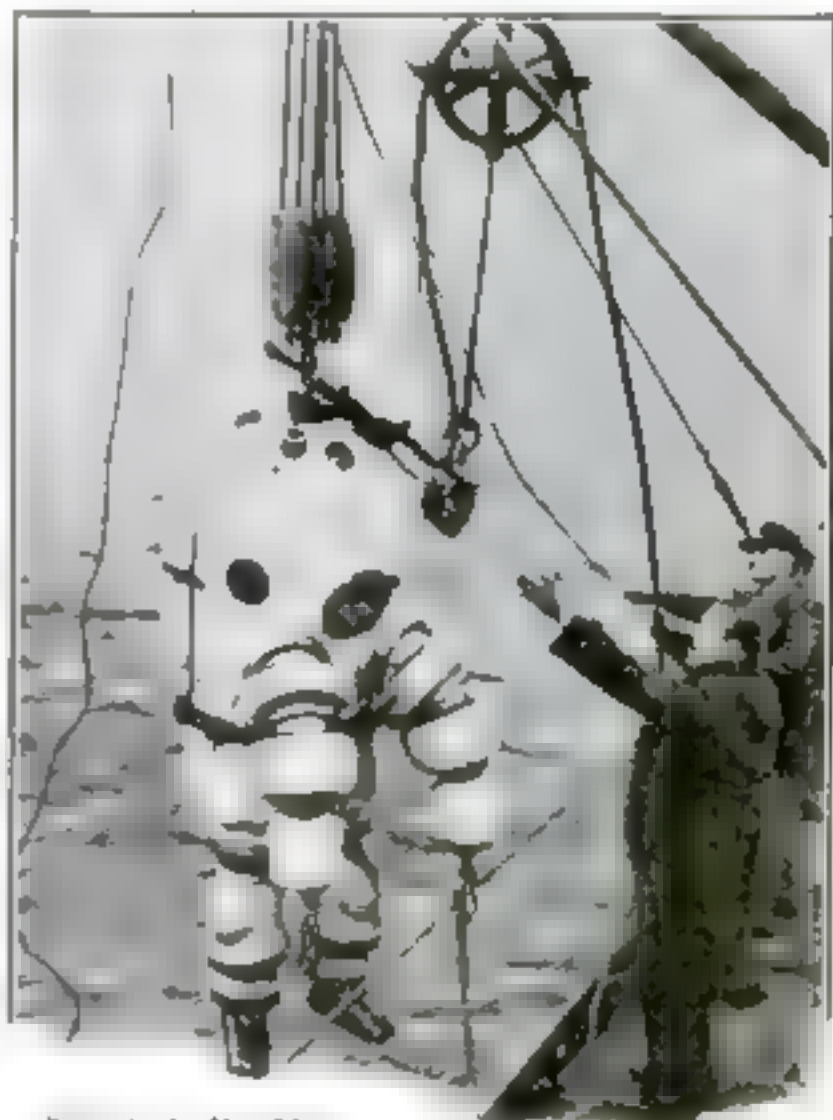
**Y**ET tremendous as is sunken wealth, it is actually small compared with the enormous natural resources of the sea in animal and vegetable life and in minerals. Scientists have counted more than 19,000 different varieties of fishes, some of which, like the menhaden and herring, are caught by the millions each year. Every year we haul millions of dollars' worth of products from the sea—foods, oils, fertilizers, pearls, leather, shells, glue.

We have barely touched its natural riches; and we have just begun to discover its hidden wonders, packed in layers upon layers, one farm and feeding ground above another, each level with its own forms of plant and animal life. The immensity of such a vast storehouse staggers our imaginations.

**H**ERE again is a compelling challenge. And the challenge is being accepted by science in a manner which, for dramatic episode and thrilling adventure, rivals any of the gripping tales of fiction. The most fascinating figure in this new drama is William Beebe, curator of ornithology of the New York Zoological Society. In previous issues of *POPULAR SCIENCE MONTHLY* you have read of his wonderful explorations on barren Galapagos Island—the "world's end"—and of his voyage of discovery into the Sargasso Sea, that ocean wilderness in the Atlantic. Now, having fished from the depths amazing creatures that never before had been seen, he returns home to report his finds and to prepare for new adventure.

And for picturesque setting and lively romance, the new adventure promises to surpass anything in deep-sea mining. This is indicated in the recent announcement that Harrison Williams, New York financier, has purchased the palatial million-dollar yacht *Vanadis* (to be renamed the *Warrior*) and is transforming her into a wide-cruising laboratory from which scientists will plumb the undersea for fresh wonders.

Truly the sea still remains the great frontier of the world. On earth the spots that remain undiscovered can be counted on one hand. But the ocean is still mostly mystery—deep, dark, wonderful, rich.



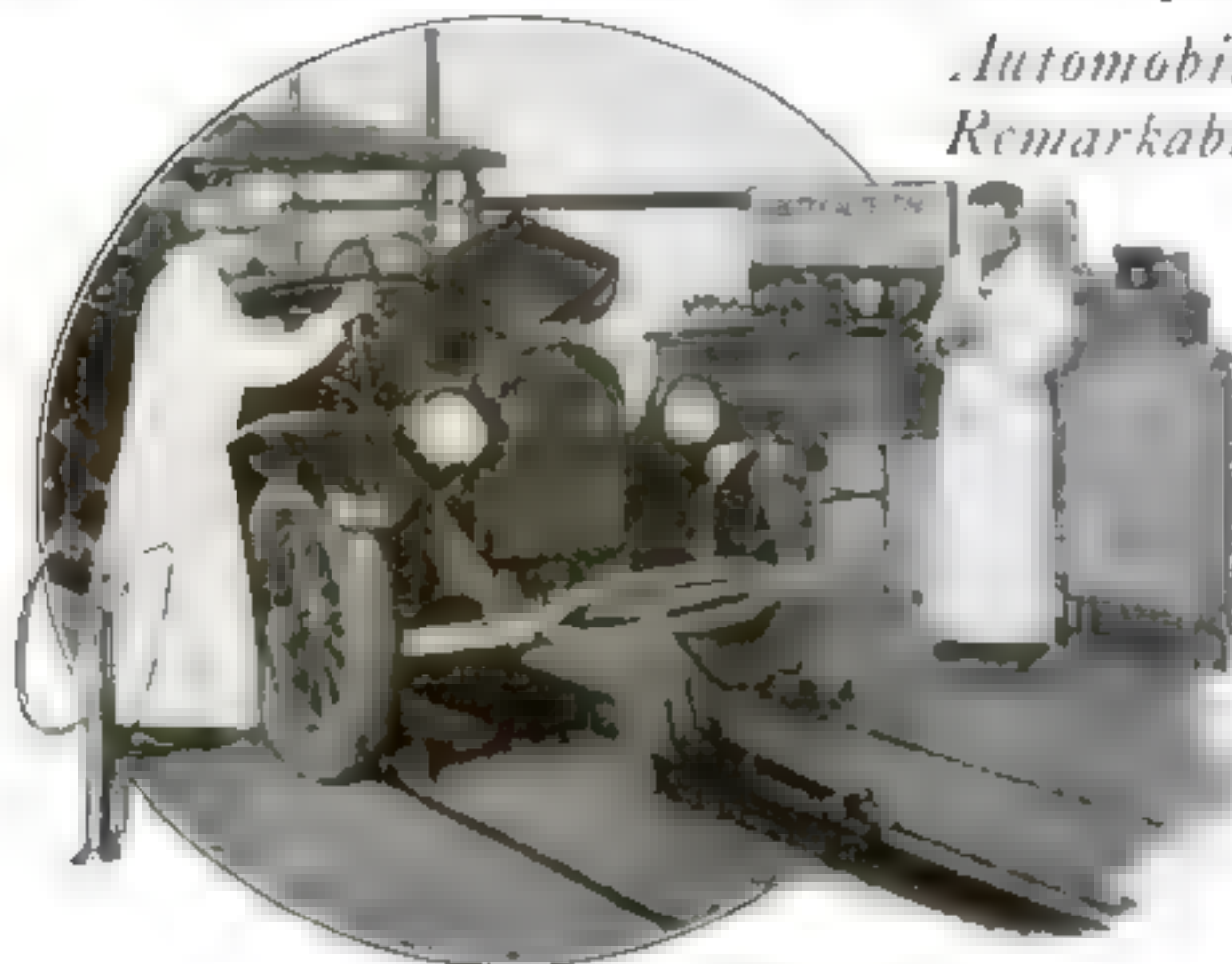
### New Suit Doubles Diving Depth

This stranger-looking steel-and-aluminum diving-suit permits a descent of 600 feet—almost twice the distance formerly possible.



# A Mechanical Doctor for Motor-Cars

*Automobile Ills Diagnosed in Remarkable Chicago "Hospital"*



Listening for Knocks in the Heart of a Car

The "doctor" at the left is holding a special stethoscope connected with a vacuum-tube amplifier through which the man at the right with head phones, listens for engine knocks

By Fritz Blocki

**A** MECHANICAL doctor for diagnosing practically any ailment of an automobile and for detecting any symptom of minor "illness" to which it is subject, is one of the newest contributions of science toward increasing the efficiency and prolonging the life of the motor-car.

This remarkable new apparatus, the invention of P. E. Edwards, of Chicago, automatically puts a car through a thorough physical examination with exacting test instruments, to determine the working efficiency of its various parts, much as a physician puts a human patient through exercises and movements to test his respiration, temperature, blood pressure, and other indices to his health.

Here are a few of the things that the mechanical doctor finds out about a car: Knocks are located; electrical conditions tested; the horsepower is measured as it is delivered to the rear wheels; the amount of friction in the motor, the rear wheels, and the axle determined; the condition of the wristpins, connecting rods, and pistons is ascertained; compression of cylinders measured; and the amount of dilution in the crankcase oil examined.

**A "DIAGNOSIS"** is made as follows: The car is driven on the testing apparatus so that the rear wheels rest on two large revolving drums set into the floor of the laboratory. These drums are geared with a device for measuring horsepower, known as a "dynamometer."

The car is put in high speed and the throttle opened wide. Resistance then is thrown against the driving wheels through the dynamometer, thus making the car

"climb" the steepest hills. Then the amount of torque, or pounds of pull exerted by the car on the dynamometer is measured. Since it is known how much horsepower the motor itself develops, any loss of power may be determined, after which the trouble is traced and directions given for eliminating it. Any knocks that develop under load are located.

Again the dynamometer is used, this

time as a motor, to turn over the wheels of the car with its ignition turned off. The amount of torque once more is measured, giving the amount of friction in the rear axle, drive-shaft, and motor.

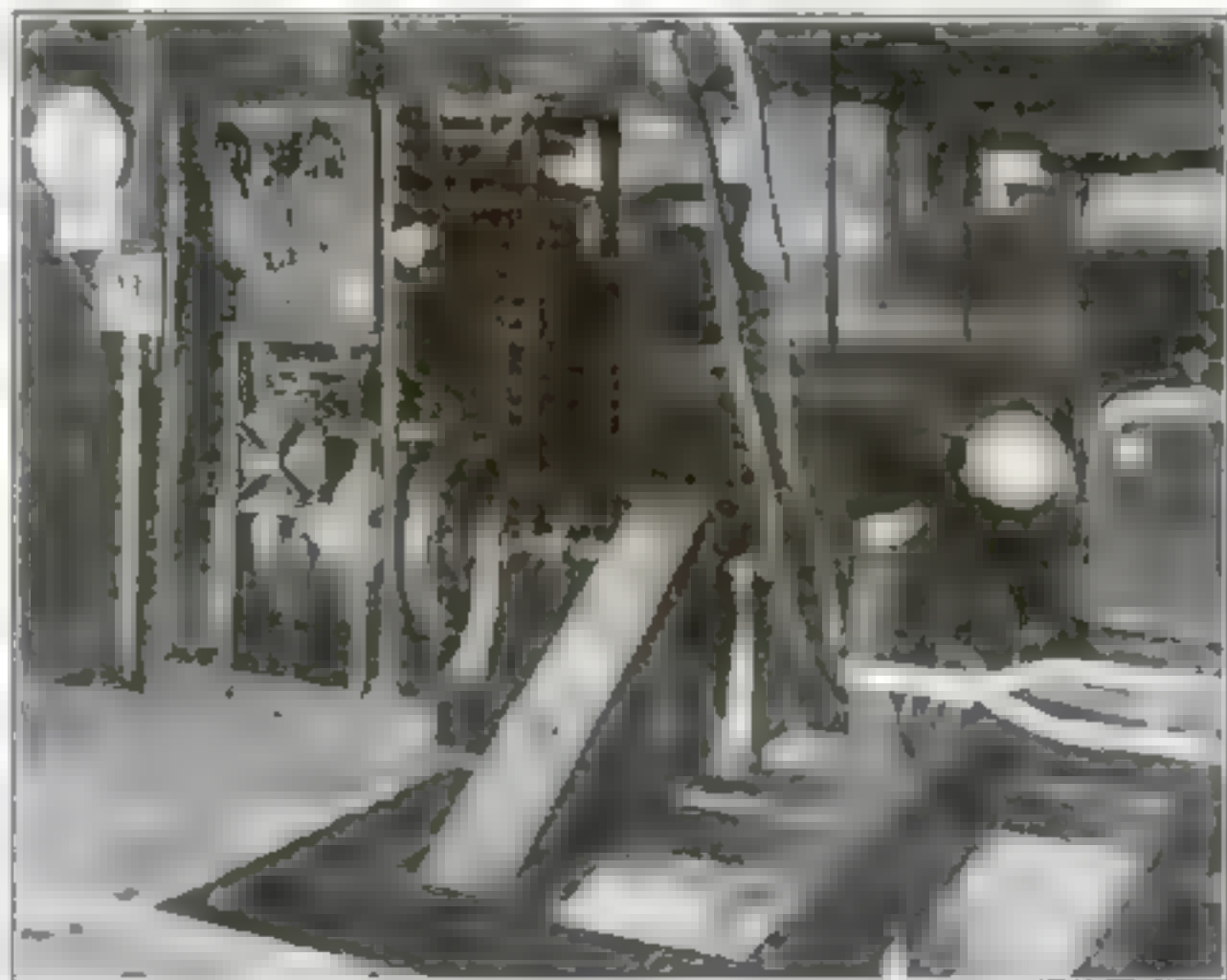
While the horsepower is being tested, gasoline consumption is measured through a flow meter.

By using a process pump inserted in the spark-plug hole of each cylinder, and then pushing and pulling by means of expansion and contraction of air, the condition of pistons, wristpins, and connecting rods is determined and piston slap is located.

**ELECTRICAL** connections on the generator, starting motor, and battery are checked by connecting them with special meters. Compression in the cylinders is learned by screwing compression meters into the cylinders in place of the spark plugs, then turning over the motor. If gasoline is leaking into the crankcase oil, such leakage is shown when a sample of oil is distilled to determine the exact amount of dilution.

The rear of the car next is jacked up to examine the wheel bearings. The mechanic goes under the car and with a stethoscope listens for undue noise in the transmission and rear axle while the car is "running."

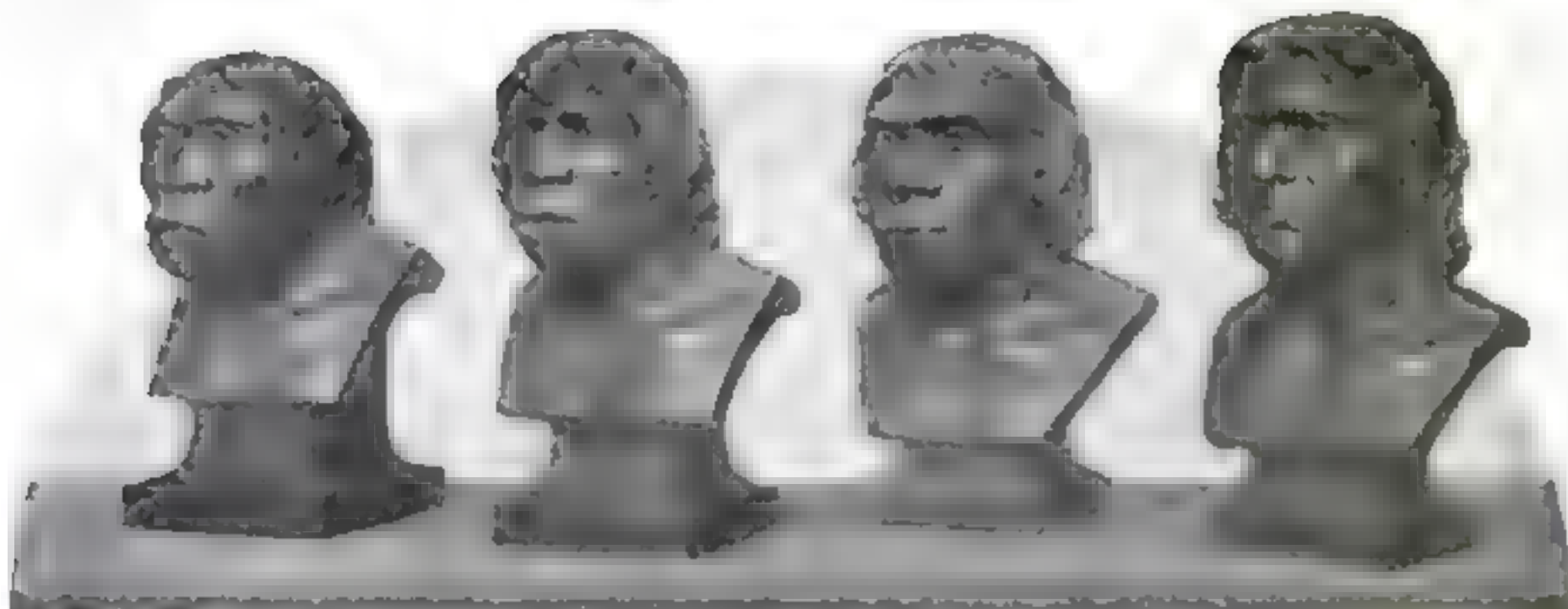
When the test is finished, a detailed report is given the car-owner. This report is used as a prescription for getting whatever repairs may be necessary, after which the "doctor" again sees the car.



Where Autos Are Tested by the "Mechanical Doctor"

The car is driven on a platform so that the driving wheels rest on revolving drums geared to a dynamometer (left). This measures working horsepower and "pull" of the car.





In these models based on the recovered bones of prehistoric men of successive ages, science finds evidence of evolution. Left to right: the Java "ape-man" believed to have lived some 500,000 years ago; the Pithecanthropus man, 175,000 years ago; the Neanderthal man, 25,000 to 50,000 years; and the Cro-Magnon man, 20,000 years.

# Just WHAT Is Evolution?

*The Much-Debated Theory of Man's Origin Explained in a Nutshell—Points of Evidence Offered by Science*

THE letter on this page from one of our readers arrived in the Editor's mail along with a score of other requests of similar nature. It convinced us that there was a real public need for a clear, concise statement of the subject of evolution, which in recent weeks has aroused bitter controversy and widespread discussion. For that reason we asked the director of POPULAR SCIENCE MONTHLY's Information Department to prepare a reply—one that would tell in terms that everybody could understand, just what the evolution theory is. The reply follows.

DEAR MR. KLINGEGER:

In the recent deluge of statements about evolution many of them contradictory, some of them misrepresentations, and others colored by passion, it is not surprising that you found it difficult to define the theory. As is often the case, such an over-abundance of explanation and argument has the effect of complicating a subject that actually should be simple.

The simplest and most adequate definition of evolution I have found consists of just two words—"orderly change." The theory of evolution is simply a theory that our world as it is today and all life upon it, have been developed since the beginning of time by slow, orderly processes of change, and that these changes are continuing.

This theory is regarded by present-day scientists as the only adequate scientific explanation of the mysteries of the origin and development of life. It brings to-

gether the collected knowledge of mankind to show that every animal, every plant, and every piece of matter around us has sprung from a few simple forms, changing through the ages usually from the simple to the complex, and toward greater perfection. In fact, it holds that

an instant. It interprets the Biblical story of creation liberally rather than literally.

As to just how Nature is believed to carry on her slow processes of evolution—how one form gradually is developed into another; how from a single cell in the sea has come man, the highest and most intricate form of creation—science likewise has its theory supported by study and observation.

Briefly, the most commonly accepted theory, as first propounded by Charles Darwin in the middle of the nineteenth century, may be summarized as follows:

NO TWO individual plants or animals ever are exactly alike. A small variation in one individual may make him better equipped to cope with his surroundings than others of his kind. In the strenuous competition of life, only the individuals best equipped for the struggle for existence survive; the poorly equipped die out. Those that survive pass their useful characteristic down to succeeding generations by heredity. And so through countless generations, by the survival and propagation of the most fit amid different and ever-changing surroundings, in-

dividual variations work to form new species, new families, and new races. So life has progressed slowly from the single cell, through the shellfish, fishes, reptiles, birds, mammals, and finally to man.

This theory of how life has evolved is known as "natural selection." A similar

## A READER asks—

THE EDITOR, POPULAR SCIENCE MONTHLY

Dear Sir: Several of my friends and I discussed evolution the other night. We all felt that as a result of all we had read on the subject during the Scopes trial we knew a great deal about it. But when we got down to brass tacks, no one of us could define the theory of evolution exactly, nor could we state definitely the reasons scientists have for believing in it.

Now you may think it remarkable that a group of so-called intelligent people in this day could be so ignorant, but I have made inquiries and have found a number of others who are in the same boat as ourselves.

I am wondering if you will be so good as to refer me to a book that will answer my needs; or perhaps you could spare the time to write me a letter telling us what we want to know.

Yours very truly,  
J. C. KLINGEGER.

Meadville, Pa.

all life, including man himself, probably developed from a single form—a mere cell.

This evolution, as a philosophy of change, is directly opposed to the philosophy of fixed unchangeability. It contradicts the idea of "special creation"—that everything on earth was completed in



process, known as "artificial selection," has been utilized by modern man in the creation of new species of plants and vegetables and in the breeding of horses and cattle. It has been applied to even the rearing of better human families.

In recent years certain aspects of the theory of natural selection have been open to serious question. But while scientists have differed as to the *how* of evolution, they are practically as one in maintaining that the *historical fact* of evolution is supported by increasing and overwhelming evidence. The main points of evidence they submit are these:

1. There are many definite indications that all animals, man included, are akin; that all were evolved from the same ancestor far back in the dim ages. The structure of all animals, including man, follows the same general plan. All have similar organs, such as brain, heart, and lungs, performing similar functions. Man's skeleton can be compared, bone for bone, with that of a horse, a monkey, a seal, or a bat. His limbs have their counterparts in the fins of a fish or the wings of a bird. His muscles correspond with those of other mammals.

This similarity extends also to the senses, emotions, and instincts. Men and the animals have the same five senses and similar sense organs. They show the same emotional reactions, such as fear, jealousy, and anger. They also suffer similar diseases and are affected in much the same way by drugs and stimulants.

The animals that most closely resemble man, and consequently appear to be of closest kinship, are the apes, particularly the orang-outang, the gorilla, and the chimpanzee. Yet scientists never have contended that man is descended from the apes or monkeys. What they do suggest, and what research has tended to substantiate, is their common ancestry, probably in a little tree-dwelling animal resembling the lemur.

2. The history of life on earth as read by geologists in the rocks. Fossils found in successive layers of the earth's crust show that the lowest, simplest forms of life came first. In layers where sediment of ancient sea and lake bottoms were raised by earth upheavals to form land, scientists have read the story of creation. In the very oldest rocks there are no fossils, indicating an age before life began. Above these, in the stratum formed at a later period, are evidences of the beginning of life—the shellfish. Then, in successive layers, each representing formations of countless millions of years, are found the age of fishes, then the age of coal plants and of frogs, then the age of giant cold-blooded reptiles that dominated sea and land, and finally the mammals, the lowest orders first, followed by higher and higher development, until finally man emerges.

In the rocks, too, has been read part of the fascinating development of man. Scientists have discovered bones of at least seven distinct types of primitive men who lived on earth thousands of years

before the dawn of history. The picture on page 25, showing the reconstruction of four of these prehistoric men in the order of the ages in which they lived—the pithecanthropus, or famous "ape-man" of Java, the Piltdown man, the Neanderthal man, and the Cro-Magnon man—illustrates the striking comparative evidence of how man has evolved. Scientists point to the fact that the more ancient the type, the closer the resem-

in its last stages of development does the human embryo differ markedly from that of the ape.

And even after birth the human child still continues to develop in a way that closely parallels the scientific theory regarding the development of the race. As soon as it begins to use its limbs it starts life as a quadruped, and later makes awkward attempts to stand erect. Its language at first is strange noises. Also scientists call attention to the fact that the normal child, when beginning to play, evidences an unmistakable instinct for cave-digging and tree-climbing, and engages in other sports that resemble closely the activities of prehistoric man.

4. Further corroboration in the bodily structure and equipment of man. In the human body we find an amazing number of muscles and organs—nearly 200 of them—which are useless or practically useless to us, but which still serve important functions in lower animal life. These are called "rudiments" or "vestigial."

Incomplete parts that have been arrested in development. Such are the muscles for wiggling the ears and those for causing the hair to stand on end. Then there is the vermiform appendix, which not only is useless, but often dangerous. It is believed to be a vestige of a time when our ancestors were grass-eaters, in grass-eating animals this organ plays an important part in digestion.

The scanty, downy hair that covers the human body, the practically worthless molar teeth that come comparatively late in life and decay quickly, the dwindling little toe bereft of one of its joints—these, according to science, are other common rudimentary reminders of our ancestry. And each of us carries about with him the rudimentary bones of a tail! Higher animals, other than man, also carry similar reminders of possible humbler origin. The splint bones in the horse's leg, for example, are explained as vestiges of toes that once were useful when he was a little three-toed animal.

5. New kinds of plants and animals actually are originating and developing today. Continually naturalists are observing how variations in an individual reappear in successive generations. From one kind of plant or animal they see new kinds produced. Within the last 10 years, for example, Thomas H. Morgan of Columbia University says he has observed scores of new forms of fruit fly that never before existed. Similar creations of new species within the span of a few years are reported to have been observed among land anolis that live in forests and jungles of many islands of the South Seas.

Another interesting example is the tomato. Not many years ago tomatoes were called "love apples," believed to be poisonous. They were scarcely fit to eat—mostly juice and seeds. Today a dozen luscious varieties of varying shades and sizes have been developed from them. Again, the potato in its first known

(Cont. read on page 150)



blance to the ape. Measurements and comparisons of skull and brain have convinced them of a definite development from lower to higher intelligence.

3. Corroboration in the life history of the individual. The life history of every man and animal is but a short, spectacular repetition of the story of the evolution of man from the simplest forms, as told in the rocks. The beginning of each one of us is a single cell, which multiplies. Before birth, the human infant resembles in turn a fish, an amphibian, a primitive reptile, a primitive mammal, an ape. At one stage he has gill slits; at another, he has a well-defined tail. Until the last three months before birth he has dark soft hair covering the entire body except the palms of the hands and the soles of the feet. Occasionally a child is born with a primitive tail still external. Only



# Our Unseen Foes in the Air

## How Nature Protects Us Against Millions of Dust Particles that Invade Our Bodies

By Newton Burke

**T**HERE are many queer things in the air we breathe; most of them dangerous, many of them a real menace to life and health. Especially is this true of cities, where factories, hurrying crowds, and rushing vehicles all contribute to the invisible enemies that attack us as we drink in the oxygen essential to life.

These unseen foes, recent scientific research shows, ride on dust particles stirred up by the feet of pedestrians and the wheels of traffic. The average person inhales about 30 cubic inches of air each time he breathes, in which there are likely to be between a half-million and a million particles of dust carrying such dangerous components as—

Germs of many diseases, including tuberculosis

Garbage, pollen, leaf dust, and other vegetable matter

Steel and other metal particles from factories, car tracks, and the moving parts of motor vehicles

Soot and dust from factory smokestacks

Insect eggs and fragments of insect bodies.

Poison gases from industrial furnaces and, probably the deadliest menace of all, carbon monoxide from the exhaust pipes of motor vehicles.

The only reason we can withstand the ravages of our unseen enemies of the air is that we have been provided with a marvelous mechanism for repelling their attacks. Most of the germs in the air do

us no harm because they are dried out. This is true of germs of typhoid, diphtheria, and tuberculosis. Moreover, no germ, even if harmful, can injure us until it gets into the blood, and formidable barriers have been set up to prevent this. The mucous membrane in the nose and throat traps solid particles such as steel shivers, sand, and soot. Thousands of delicate hairs in the lining of the windpipe and bronchial tubes catch stray particles, while at the root of the lungs are lymph filters.

Particles and germs getting beyond these first lines find waiting a powerful army of about 35 billion red corpuscles in the body, each capable of choosing what it will deliver to the body cells and what it will dump as garbage.

Then, swarming in the blood are phagocytes, hollow cells that devour microbes. Finally come the leucocytes, white cells that destroy harmful bacteria and waste material. A disease germ has little chance against this formidable array.

Science now is turning its attention



Sanitary inspectors taking samples of air from New York City streets to determine the actual danger to human beings from carbon monoxide gas discharged from thousands of motor-cars.

to the gases; for evidently nature did not foresee automobiles and provided no safeguards against carbon monoxide poison they produce. This poison is admitted into the blood as readily as oxygen. Slightly more than a quart of carbon monoxide is enough to kill a person, and the average automobile, according to tests made recently by the United States Bureau of Mines, produces up to two cubic feet of it a minute.

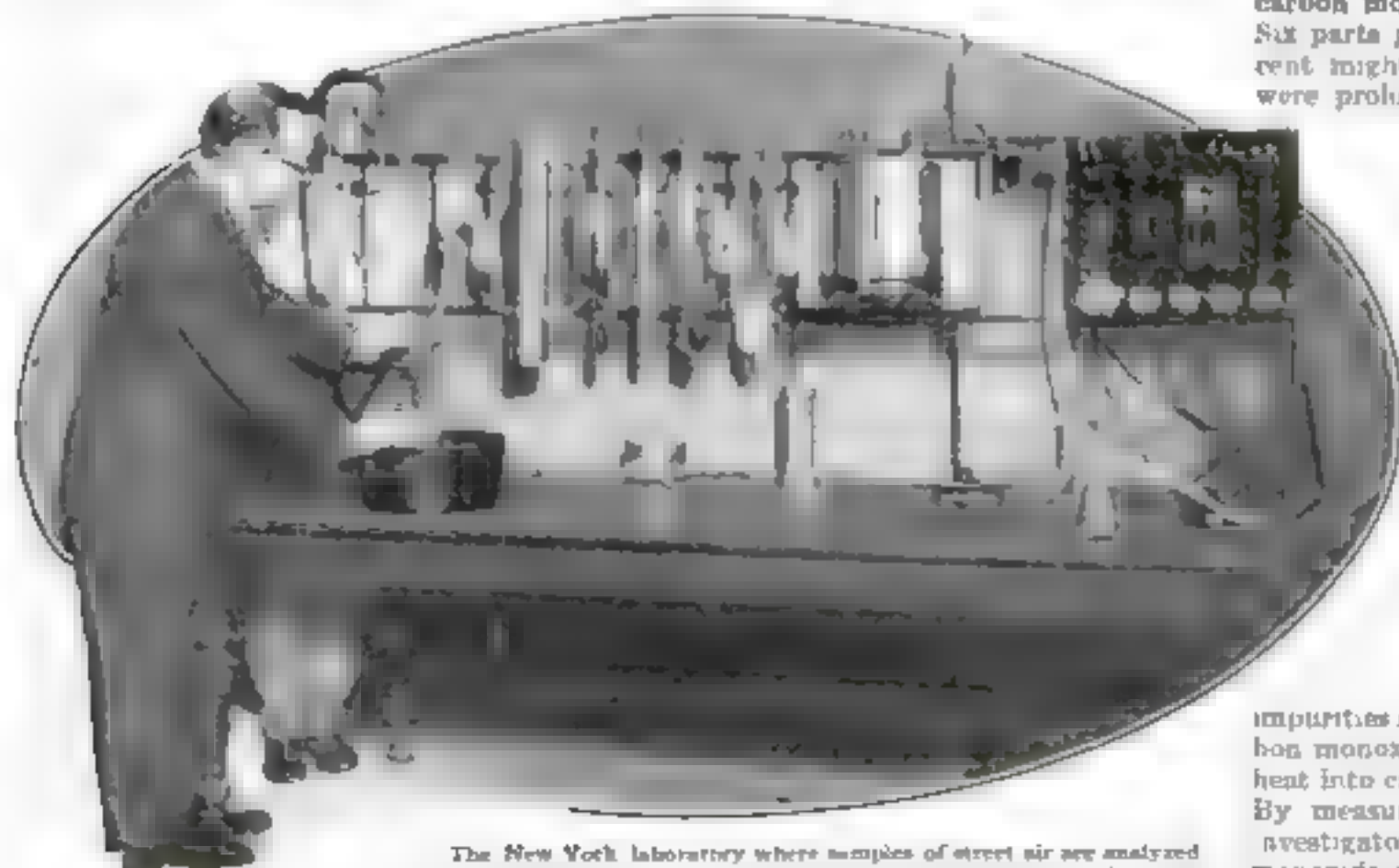
A man can just tolerate four parts of carbon monoxide in 10,000 parts of air. Six parts produce headache, and one per cent might cause death if the exposure were prolonged. Vapors from an automobile exhaust sometimes

sometimes contain as much as 10 per cent carbon monoxide.

New York City recently began an investigation to determine just how dangerous carbon monoxide on city streets is to public health. With oddly shaped glass tubes and a small suction pump, scientists have taken samples of air from street corners where traffic is greatest.

These samples are passed through an apparatus that separates the air into its various parts.

Various chemicals absorb impurities and gases until finally only carbon monoxide is left. This is changed by heat into carbon dioxide and free iodine. By measuring the iodine liberated, the investigators can tell the quantity of monoxide originally in the air.



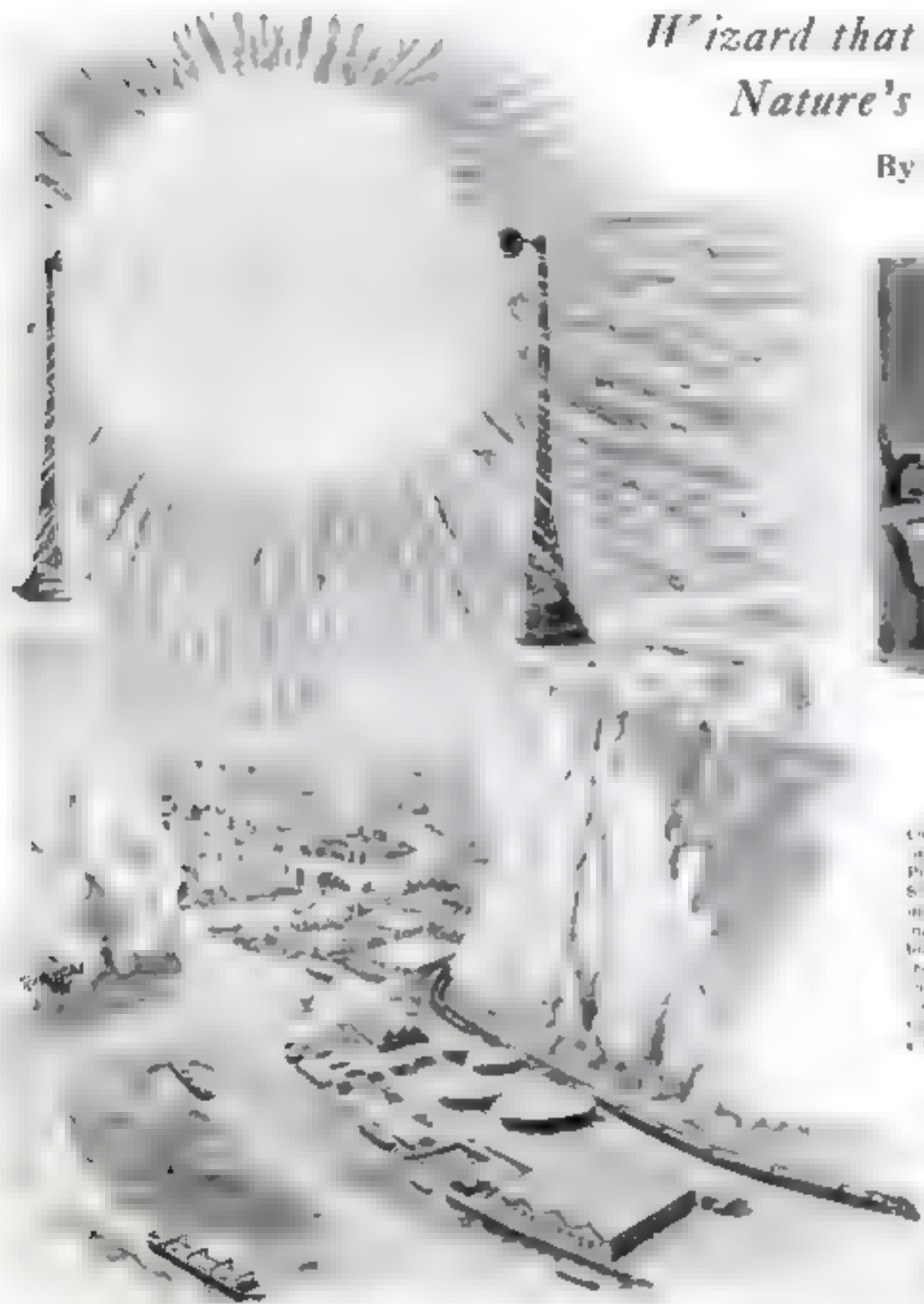
The New York laboratory where samples of street air are analyzed and studied in an effort to conquer the invisible foe of health.



# Can Man Reproduce the Sun?

*Dazzling Experiments Convince French Wizard that Science May Rival Nature's Vast Power Supply*

By Frederic M. Delano



## How Man-Made Sun May Appear

One of the most important experiments in the history of science is being performed in the laboratory of Professor Jean Perrin, a French physicist, at the University of Paris. The experiment is designed to produce a small-scale model of the sun's interior, where the intense heat and pressure cause the atoms of matter to break up and release energy in the form of light and heat. The experiment is being conducted in a large, dark room, where the only light comes from the experiment itself. The results of the experiment are being recorded on a large screen, which shows a bright, blue-white flame or arc of light, similar to the one shown in the illustration.

world of science and practical research that, Professor Perrin," I questioned my eyes still dazzled by that blinding flash. "What you say to be taken literally, do you actually hope to produce an artificial sun?"

"On a small scale—yes," he replied simply. "What you have just seen is the beginning of the process. When I have a machine of sufficient power, I can complete it. For with 10,000,000 volts of direct-current electricity, I believe I can break up the atomic structure of matter—disintegrate individual atoms, perhaps even drive the nucleus of one atom into another atom and thus create a much denser atom. If I am able to do that, the secret of the sun's radiation will have been solved."

"I BELIEVE," he continued, "that the sun is formed by the constant changing of the extremely light atoms of hydrogen into atoms of greater density, such as atoms of oxygen, nitrogen, and the other heavier elements. According to my theory—and many other scientists agree with that theory—everything in the universe—the sun, the stars, the planets, and everything on them—once consisted

**L**EAPING across the gap between the electrodes of a giant electric machine, the mighty arc of blue-white flame dazzled my eyes with its awful intensity. A terrific crackling roar smote the quiet of the laboratory. My senses reeled before this revelation of almost unimaginable power.

Professor Jean Perrin, white-haired, white-bearded, benevolent-faced, opened a switch with a long-fingered white hand. The dazzling glare was smothered out. The crackling ceased. In the sudden quiet even his low-pitched, pleasant voice sounded loud.

"It is but the beginning," he said. "Soon I shall have available a means of producing 10,000,000 volts of direct-current electricity. Then, perhaps, I shall

be able to reproduce, on a small scale, the conditions that cause the radiation of light and heat from the sun and the still more gigantic stars of the universe!"

I gazed at him in amazement, scarcely comprehending the significance of his words.

Was this man actually voicing the hope that he might rival Nature itself? Usurp the power that drives the universe?

It seemed incredible. And yet, I recalled, it was no crack-brained scoundrel talking, but a noted scientist, whose opinions are respected by scientists the world over. Head of the laboratory of physical chemistry of the famous University of Paris, member of the French Institute—it would be difficult to find another who occupies a more stable position in the



of atoms of hydrogen, and these have changed gradually into heavier atoms that make up our atmosphere, our soil, our rocks, our own bodies.

"Nearly all scientists now agree that atoms themselves are composed of positive nuclei and negative electrons. Each positive nucleus and the negative electrons that rotate around it form, it is believed, an infinitesimally small solar system; so small, in fact, that billions of these complete solar systems in miniature are required to make up the visible material that composes the point of an ordinary pin, for instance.

"**A**TOMS, of course, are so exceedingly minute that it is almost impossible for us to conceive a satisfactory picture of them. The number of atoms of oxygen and hydrogen in an ordinary pail of water undoubtedly exceeds the number of grains of sand that would be contained in a beach 50 feet wide, encircling the entire continent of Europe.

"It is difficult, too, to form in our minds a definite picture of the structure of the atom. For example, scientists believe that if an atom were as large as the city of Paris, the nucleus would be about the size of a block of houses, while each electron, whirling about at a rate between 2000 and 98,000 miles a second, would be approximately as large as a taxicab.

"Now the only difference between various kinds of material, such as air or wood or steel, lies in the numbers of electrons that revolve about each of the nuclei that make up the material.

"In changing into any other element, I believe that hydrogen changes first into helium, which, you will recall, was found in the sun before it was found on earth. In doing so, a portion of its atomic weight is lost, and given off as energy. This released energy comes to us from the sun in the form of light and heat, and makes life possible on the earth.

"How did this process of constant change get started? Probably the collision of two or more hydrogen atoms, or groups of atoms, produced the first energy. As a little match will set fire to a great forest, so this collision set going the con-



#### He Hopes to Blast the Atom

Prof. Jean Perrin, head of the physical chemistry laboratory at the famous University of Paris, who says that soon he will have the means of producing 10,000,000 volts of direct-current electricity. With this he expects to reproduce on a small scale the conditions that cause radiation of light and heat from the sun.

stant reaction that, by always creating heavier atoms from those of minimum density, produces the sun's heat.

"By hurling against the atomic structure 10,000,000 volts of electricity, I may be able to produce this change of light atoms into heavier atoms, and thus, in effect, create another sun."

I recalled to Professor Perrin that the late Doctor Steinmetz and his co-workers in America already had produced in the laboratory thunderbolts of a million and two million volts.

"**T**HAT is quite true," Professor Perrin explained. "But he was working along different lines and he used alternating current. To break up the atom, one must have direct current so that a definite potential, either positive or negative, can be applied to the atoms you are trying to disintegrate.

"Hitherto the greatest direct-current voltage obtainable was between 250,000 and 300,000. My machine, however, delivers almost 600,000 volts. Greater direct-current generators undoubtedly will

be built. Eventually we shall have one capable of producing 10,000,000 volts. Then we can proceed with our work."

I pondered over what he had told me, and immediately the thought occurred—suppose he succeeded in accomplishing his astounding plan. What would that mean to our world? If the series of atomic changes he described had spread like wildfire on the sun, how could we know that the same thing would not happen on earth were man to reproduce artificially the conditions that created the sun? Would it not break up the entire atomic structure of the universe? Would it not cause our world to burst into flames and burn us all into cinders in the twinkling of an eye?

**I** ASKED Professor Perrin these questions. He replied with a Gallic shrug of his shoulders. "Disaster," he admitted in his quiet voice, "is a possible consequence of smashing an atom. But it is the duty of the true scientist to investigate all phenomena. It is only in that way that we may learn. We must not be afraid."

Then a smile curved the lips of the white-bearded scientist. "But disaster is highly improbable," he added, "and the possibility of disaster is outweighed by the tremendously useful possibilities contained in the process I have in mind. Consider: Our civilization is built on machinery; that would be useless without power to run it. Our supplies of coal and oil will not last forever. There is only a limited quantity in the earth and when that is exhausted by future generations, there can be but one result—stagnation, starvation, disaster—unless before our supplies of natural fuels are exhausted, science finds some new source of power and learns how to use it. Perhaps it will be the power generated by the disintegration of atoms that will make possible the saving of our civilization from annihilation."

And then Professor Perrin outlined for me a vivid, convincing picture of the tremendous power-producing plant of the future—the plant in which scientists may

(Continued on page 35)

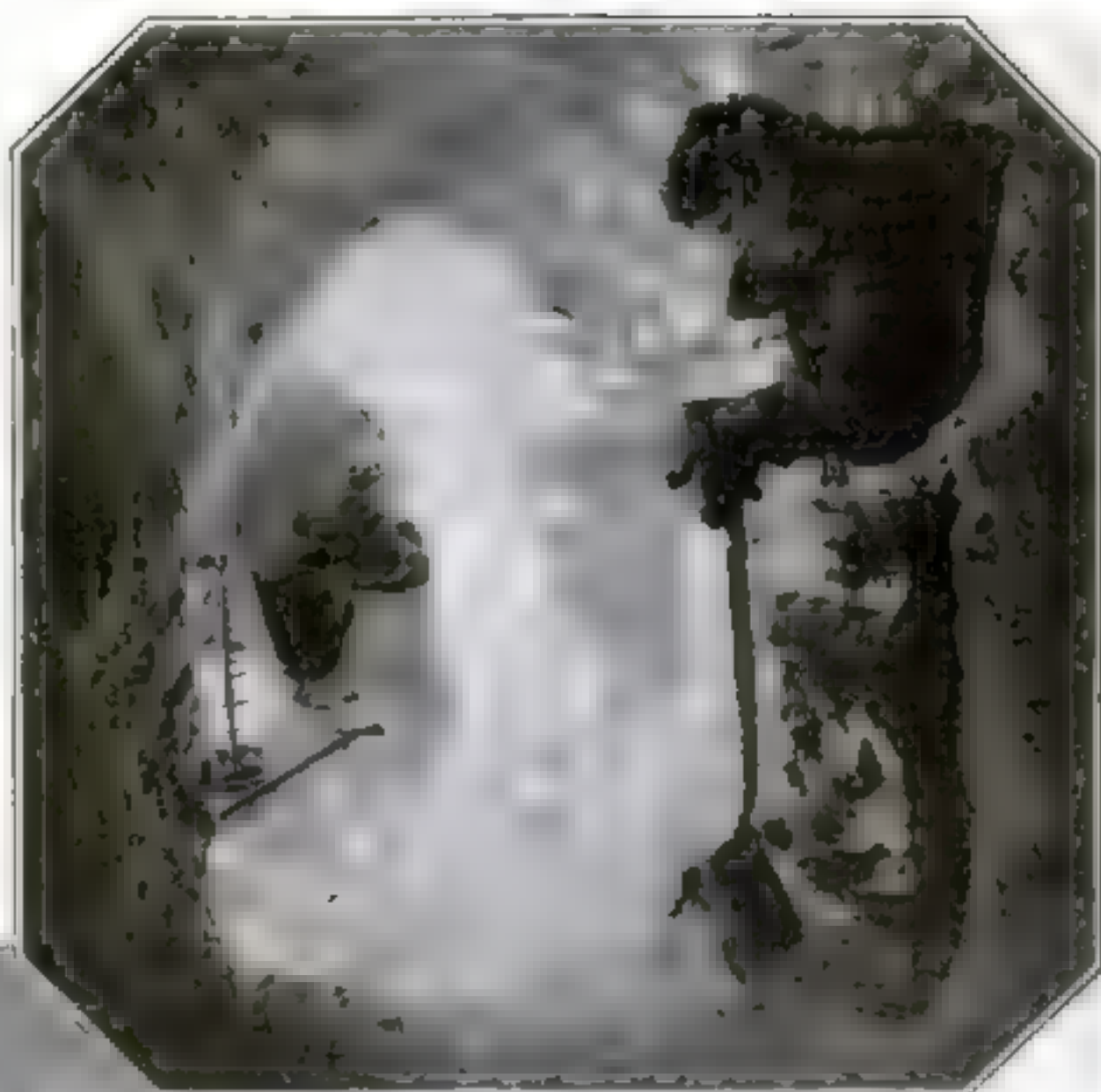


Professor Perrin's new 600,000-volt direct-current machine in Paris, with which he is conducting experiments that he hopes will lead to the disintegration of the atom. Hitherto the greatest direct-current voltage obtainable was between 250,000 and 300,000 volts.



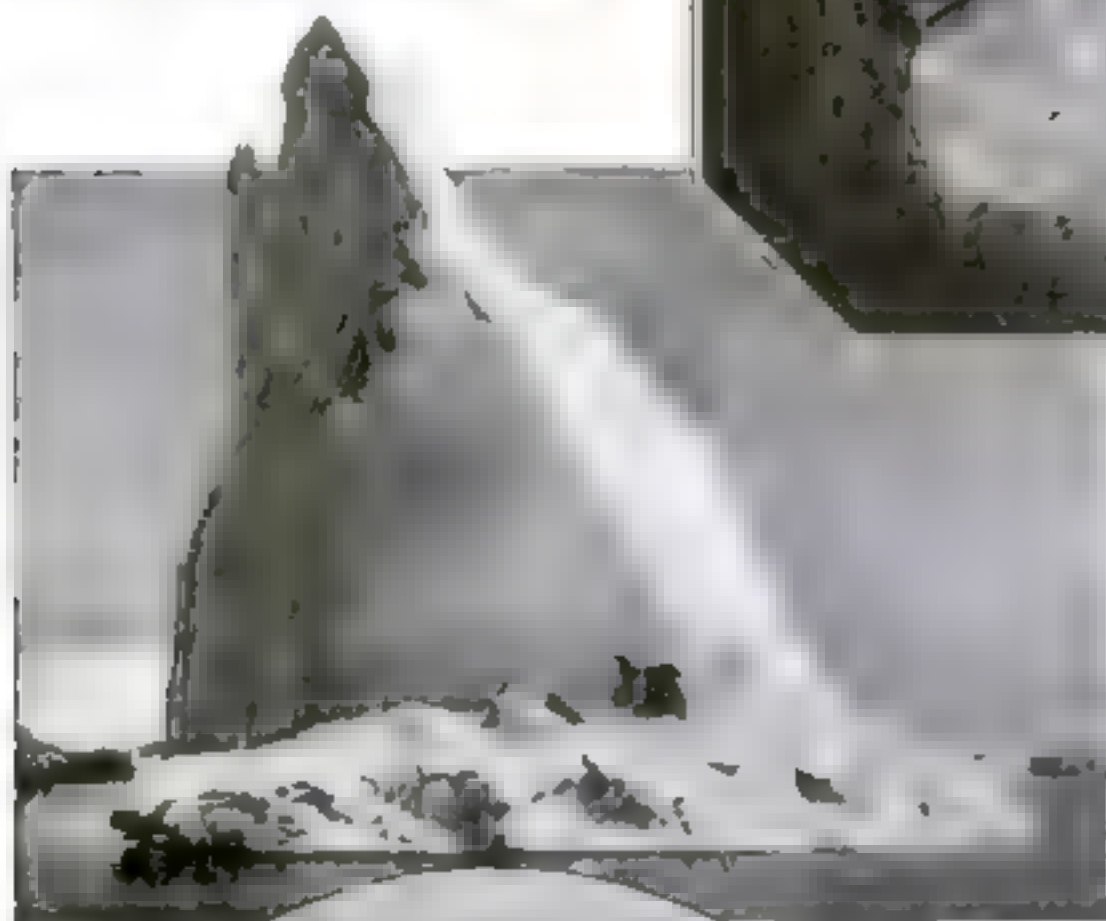
# An Ice-Locked Island of Mystery

THE growing cracks in a strange barren slope of eternal ice that lies in the Antarctic Ocean south of Cape Horn are revealed to the world for the first time in these remarkable photographs recently taken by Captain Frank Hurley, famous explorer and photographer. The land is called 'Elephant Island' and it is one of 12 islands in the South Shetland group that are entirely devoid of vegetation. Here Captain Hurley and party spent eight months of exploration.



## A Land of Gleaming White

Many of the photographs taken by Captain Hurley and his party during their expedition to the South Shetland Islands are of a most striking and beautiful character. The following are a few of the most notable ones.



In the frozen wilderness. At the left one of the explorers is seen making his way through the ice forests of the island. The picture at the right shows another member of the party looking into a deep abyss from a cliff of one of the mountains of ice.



"**Y**OUR success or failure in a new job often depends on the questions you ask in advance about the men and the concern you are to work for."



Municipal employment bureau in New York City where men usually ask only about hours and pay

# How to Pick a New Boss

*Secrets of Getting the Right Start Revealed by Science*

By Samuel S. Board

**A**T THE head of one of the greatest dry-goods organizations in New York is a man who attributes his success largely to the fact that he once turned down a \$25,000-a-year job in favor of one paying \$5000!

The reason for his astonishing decision was his deep-founded conviction that care in choosing the right kind of boss and the right kind of concern is the most important factor in business success—much more important than immediate financial return.

In the case of the \$5000 job, this man knew the employers to be men of character and ability—men he would like to work for. Of the \$25,000 job he was not so sure. On one hand he saw certain opportunity, steady advancement from a comparatively small beginning; on the other, in spite of the immediate reward, the future was at least doubtful. One position offered a chance for active interest in the business; the other was just "a job."

Look at the records of men who have attained business success and you will find, I believe, that, in almost every case, at every step along the way, they have studied carefully every prospective job, and have chosen deliberately the bosses they will work for!

In recent years scientific methods have been used more and more in reducing business inefficiency. Nowhere has the effect of these methods been more marked than in the selecting of men for jobs. Nearly every one who has applied for a job with a big corporation has met this effort in the form of an "application."

**MR. BOARD** is a leading authority on the new science of job-getting, known as vocational guidance. The advice he gives here is based on his actual experience as Vocational Director of the Central Branch, Young Men's Christian Association, Brooklyn, N. Y., where he has aided hundreds of men to fit themselves to the right job. **THE EDITOR.**

And just as it is important for the employer to know what kind of man he is hiring, so it is as important, or even more so, for the employee to know certain definite facts about the men and the concern he is to work for. Success or failure may hang on that knowledge.

Most employers whose salesmen handle money demand a bond. Yet I know of more than one good salesman who has tied up with a concern, risking both his good name and his trade repute, without anything but a perfunctory inquiry as to the firm's financial reliability. And when it has gone bankrupt in two or three months, he never has blamed himself.

A typical example of the really tragic results that often come from this lack of scientific care in job-getting recently came to my notice. A young office manager with good prospects in a New York wholesale house decided that the field in which he worked was restricted. He answered a Chicago firm's advertisement. After a few perfunctory inquiries he

agreed to go to Chicago. Upon reporting for work, he discovered that not only was his immediate superior "a crotchety old maid," but also that the firm was shaky financially. When the company went on the rocks a few months later, more than one of his acquaintances said, "Why, if only you had asked me, I could have told you they were on the toboggan. I supposed you knew when you took the chance." Simply because he failed to ask a few vital questions about his employers, he found himself out of a job at the worst possible time of year.

The average man, particularly the young man, doesn't ask very many questions when he is interviewing a prospective employer. He usually just sits and listens, although he can be depended on ordinarily to find out what the pay is, what the hours are, what department he is to work in, the name of his job (if it has one), and when he will start to work if hired.

**T**HERE are, however, other items just as essential if less obvious. In fact, it is just as possible for you to use an application in picking a new boss as it is for an employer to use an application when he is hiring you.

Of course, you can't go to Mr. Smith and Jones, and say, "Now, Mr. Smith, here's an application for my services that I should like to have you fill out, and if it is satisfactory, I'll interview you in a few minutes." But there are certain essential facts you can seek every time you apply for work. You can jot them down on paper before you interview



an employer, and then make a conscious effort to obtain the information from him.

Is the position permanent or temporary? What are the qualifications for the job? Under whom will you work? In what surroundings? To what higher position would the job under consideration lead? These are a few of the vital points any reasonable employer should be willing to make plain. Others I have embodied in the typical "application" that accompanies this article. Many of these questions may seem obvious, yet it is surprising how often they are forgotten in the excitement of getting a job.

IT WAS only last June that an enterprising young man obtained a bookkeeper's job at a summer hotel. Everything looked fine until he discovered that the proprietors were Austrians, most of the employees were Germans, as were many of the patrons. Knowing nothing of the German language, he was decidedly out of place and could not give efficient service. A few careful inquiries before he made the move would have saved him time, trouble, and expense, as well as disappointment.

Men who have spent years in specialized training and reputation building should study prospective positions very carefully. They must consider such questions as the general standing and prospects of the industry or occupation, the financial and business standing of the firm, the type of person with whom they will have to do business, both inside and outside of the organization, why the last incumbent of the position left, and whether the demands of the work are within their limits, whether these limits be physical, mental, or social.

LAST winter a man who had spent several years studying accountancy, and who had been getting about \$3000 a year, confident of his training and ability, came to New York from the South. After some search he took a job with a public accounting firm with the understanding that, while no definite sum was settled, he would be paid a salary corresponding to the work, and would find a permanent berth.

When his first weekly pay check came it was \$271. He protested, but his protests brought only promises, though he was given work for which other firms were paying \$50 and \$60 a week. It took him more than three months to find a job elsewhere at a figure near his former salary, and then he stepped out of the first organization just before most of the employees were laid off. The firm only wanted his services for the three or four months in question. They had a reputation for "stringing employees along." But the Southerner had neglected to make the inquiries necessary to reveal this and he had neglected to pin

## Facts You Ought to Know about the Job

**I**N THE following questionnaire Mr. Board has listed what he says are the essential facts to be sought whenever you apply for a new job. The best way, he says, is to study them before you interview an employer, and then make a conscious effort to obtain the information from him:

Exact name of firm or employer  
Address Phone  
Business (part of what industry or business)  
Duties . . . Pay . . . . . How paid .  
Training and education required and desirable  
Relationship to rest of organization  
Work starts Temporary or permanent  
Name and characteristics of immediate superior  
Hours Health conditions  
Type of associates  
Name and position of interviewer  
Policies and methods of hiring, firing, and promotion, including raises.  
Are they done through 1. Employment department? 2. Department heads  
or head of firm? a. Merit  
b. Connections c. Seniority  
Status of industry as a whole  
Status and reputation of this firm in industry  
Financial status  
Requirements for further progress in work  
1. Education . . . 2. Personal development  
3. Experience in the organization

his employers down to a definite salary and a definite opportunity for advancement.

Firms with reputations for fairness are particularly careful to have such conditions frankly stated.

Employee and employer alike commonly fail to consider the physical limitations of a job. A young man of excellent personality and real ability came in to see me the other day, jubilant over an opportunity with a well known ribbon house where advancement was almost certain. Yet a vocational interview showed that the young man was afflicted with a special form of color blindness, and that a ribbon house in which he would have to match the most delicate variations of color was the last place in which he could work effectively.

This Way Is a Trap



Answering an "ad" and jumping into a job without first finding out the status of the employer and what the job holds for you is likely to result only in disappointment and considerable loss of your time and effort.

He had not thought of this handicap, if he knew about it, and the employer had not tried him out.

**W**HILE in many large companies a physical examination is a part of the process involved in getting a job, such examinations usually are conducted only to determine the likelihood of the company's liability for damages in case of accident, or to meet requirements of compensation insurance policies. Seldom is an effort made to study the probable effect of the job on a man's health, and almost never is the subject considered from the standpoint of future jobs the applicant may be in line for.

Here the question of your future is clearly up to you when you apply for a job. If you would carefully build your career according to a well-arranged scientific plan, it is essential at the outset to find out what your future jobs are likely to be, and what they will demand in health, education, and social abilities.

Almost every position has some drawbacks, yet if you know the facts and study them carefully and methodically,

you will be surprised how they will help you avoid pitfalls that almost inevitably confront a man in a new job. A friend of mine recently succeeded a brilliant man. At a luncheon he was introduced by his new chief to other members of the staff with the invitation to "say a few words." It so happened that just before the luncheon one of the men had whispered to him that he should not, under any circumstances, make a speech. So he turned the invitation off with a remark about actions speaking louder than words. Later it developed that his predecessor had antagonized his associates frequently by lecturing them as if they knew little and he knew it all. Thus, any similar tendency on his part might have hampered his work materially.

Such seemingly unimportant facts as the personality of a predecessor are of almost value. The more we can learn in advance about the character of prospective employers and associates, the better we can determine our chance to fit into the scheme successfully.

**I**NFORMATION about the standing of the business as a whole and of one firm in particular sometimes is difficult to obtain, but there are trade and technical publications that give summaries of general industrial conditions and the prospects for the future. The ratings given by Dun and Bradstreet may not be available for use directly, but unless the firm you seek information about happens to be a client of your bank, the bank usually will be willing to give you a fairly definite idea of its standing. Then too, nearly every man has friends to

Continued on page 33



# U. S. Army Tests "Flivver Cavalry"

*Light Bullet-Proof Car Designed for Speedy Cross-Country Scouting*

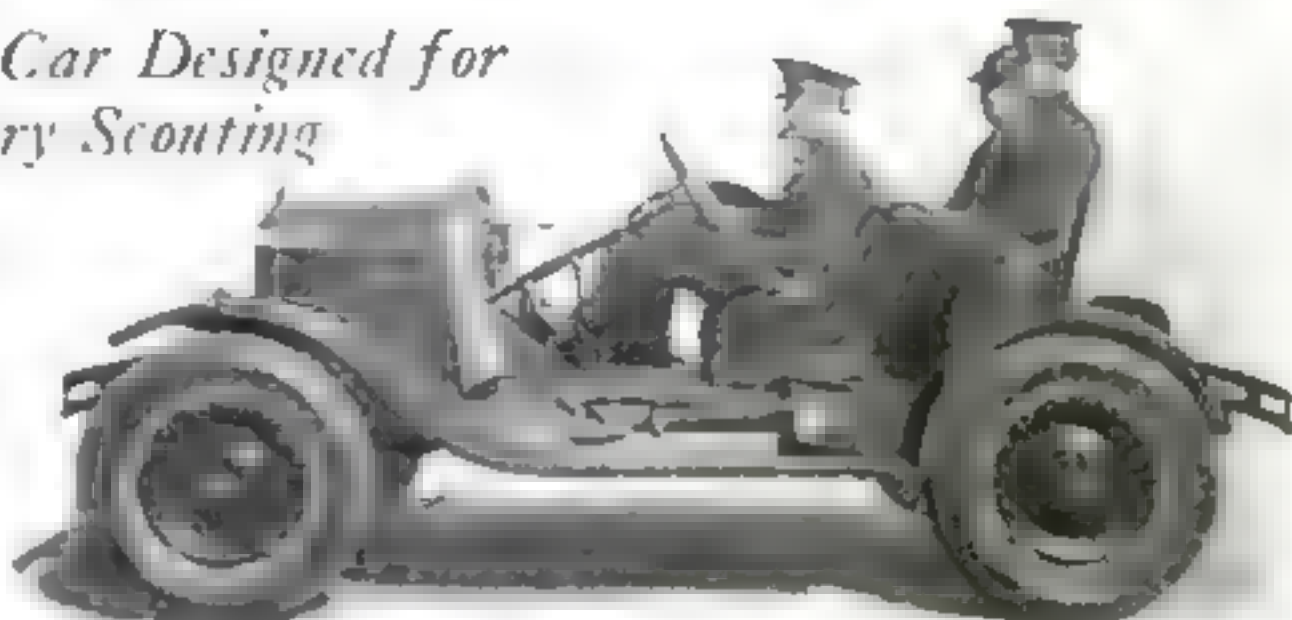
**I**NSTEAD of thrilling charges of cavalry, will future warfare see squadrons of troopers careening over rough ground in automobiles?

The U. S. Field Artillery Board recently tested a cross-country car, the vehicle that may replace the horse in battle, at the Aberdeen Proving Grounds in Maryland. After the trials the Board recommended the adoption of the car for field artillery reconnaissance, finding it superior to caterpillar-tread tractors and to motorcycles for cross-country work.

The vehicle, as designed for the Maryland tests, is a stripped Ford chassis with bucket seats, built on. It is equipped with balloon tires. An auxiliary transmission permits the low speed of three miles an hour, necessary to accompany marching infantry. The radiator and engine are protected by a bullet-proof shield.

A new transmission was added to the regular system, giving two neutrals, six speeds ahead, and three to the rear. Two stabilizers keep the body from bouncing on rough roads or across country.

For scouting work the little car has the advantages of greater speed and less vulnerability than horse or mule. Hits on any part of the bodies of animals, excepting the ears and tail, disable them; the car offers far less of a target and a far more resistant one. Poison gas is fatal to animals, but does not affect the internal mechanism of a motor-car.



**The Cross-Country Scout Car**

Giving from 15 to 20 miles to a gallon of gasoline this little car is being tested for scouting, artillery and motor transport work in U. S. Army



**Which Makes Better Target?**

The diagram above demonstrates the greater vulnerability of a mule to enemy bullets and shells as contrasted with the bullet-proof car

A horse or mule takes three years to grow, while the cars may be turned out at the rate of 6000 a day. If a horse or mule loses a leg, it is out of service for good, but a wheel or other damaged part of an

automobile may be replaced within half an hour. Also, an animal must rest, while from the motor-car 24-hour service is obtainable.

The new adjunct to the army's mobility is not only a sort of flivver cavalry; it might be called also "flivver field artillery," for its purpose is to replace the individually mounted men of motorized units, such as our tractor-drawn ordnance, and to carry out that general reconnaissance work that all guns require for selection of position and observation points. It is a unit of the motor transport, too—a unique cross-country branch of it. For that service it has a carrying capacity of 500 pounds.

A final report will be made as soon as a test car has traveled 10,000 miles.

## Fitting the Last Girder for Greatest Suspension Bridge

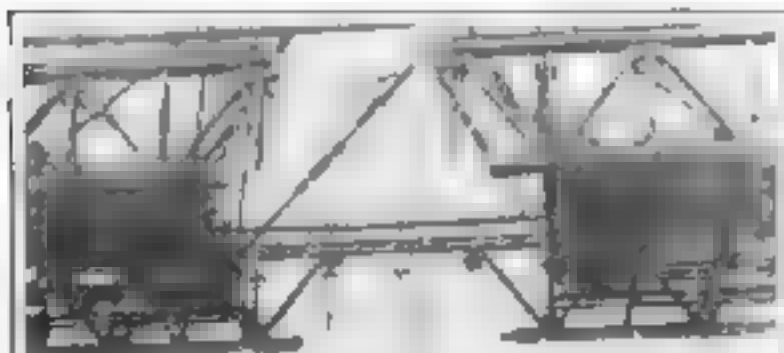
**T**HE unusual photographs below show how the last and largest girder was hoisted into its place in

the central span of the world's greatest suspension bridge, which is nearing completion across the Delaware River between Philadelphia, Pa., and Camden, N. J. The great piece of steel was swung up from the deck of a lighter below and quickly fastened in place in the center of the span.

The Philadelphia-Camden bridge has the longest clear center span ever suspended. The total length between

piers is 1750 feet—118 feet longer than that of the new Bear Mountain-Hudson River bridge, and 150 feet longer than that of the Williamsburg Bridge across the East River in New York City.

From end to end the Delaware River bridge is 9600 feet long, and from anchorage to anchorage, 3536 feet. Its huge suspension cables are made of thousands of tallow-dipped steel wires. Construction work has been under the direction of Ralph Modjeski, famous bridge engineer.



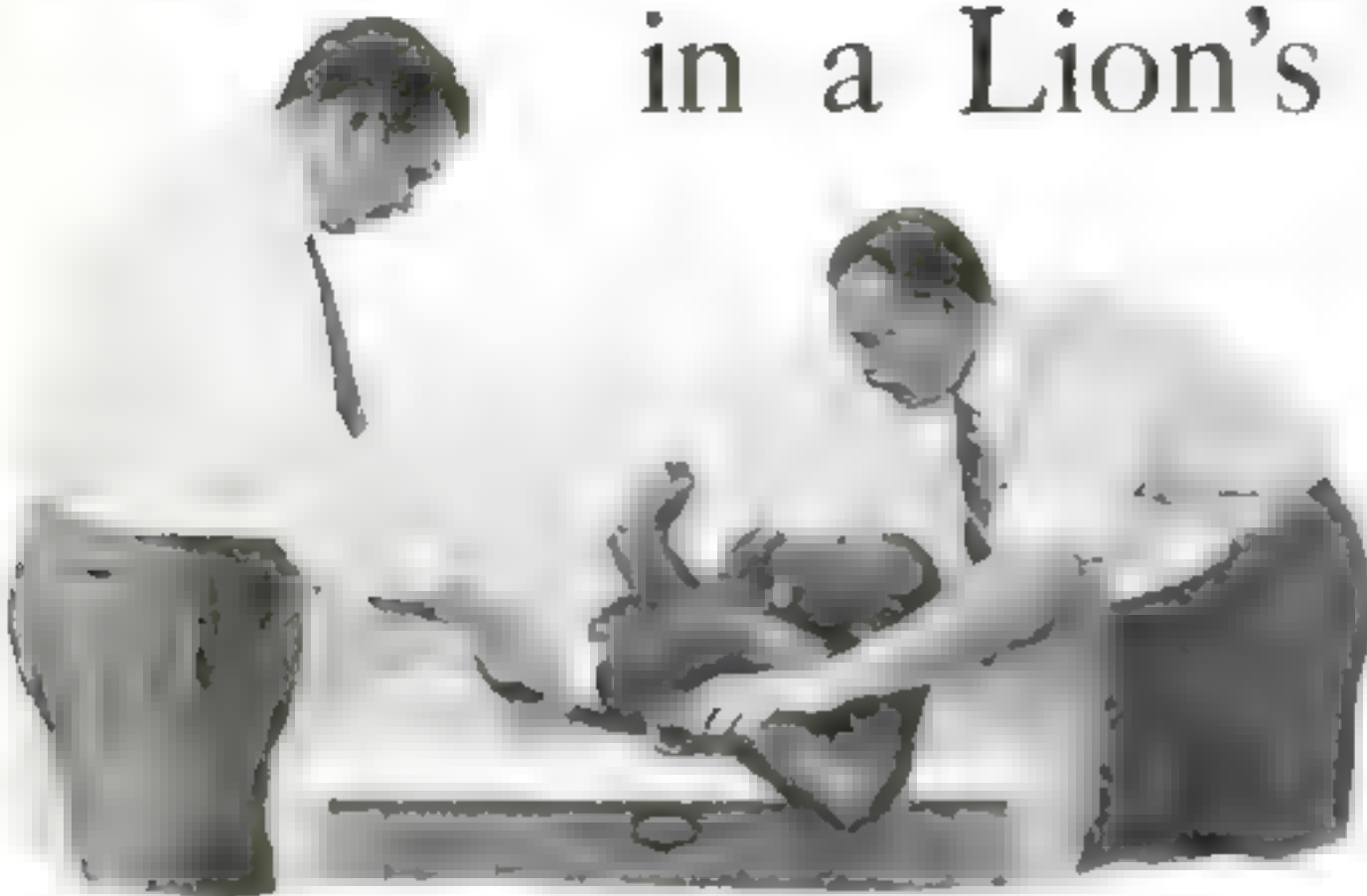
**Closing Up the Great Span**

The picture at the left shows the last girder of the Philadelphia-Camden bridge being lifted from the lighter below. At right Workmen standing ready to guide the girder into place and thus complete the great span of 1750 feet which is the longest suspended span in the entire world.





# Would You Poke Your Fingers in a Lion's Mouth?



*The Vivid Story of a Doctor Who Does and Lives to Tell of His 1500 Operations on Wild Beasts*

By Robert E. Martin

## A Hospital Case from the Monkey House

Monkeys make satisfactory patients: some even seeming to enjoy the attention they get when in the hospital. Doctor Blair is shown above dressing a broken leg of an ape.

**H**OW would you like to stick your fingers in a lion's mouth when the proud king of the jungle is convulsed with pain and rage from an abscessed tooth? And how would you like to force food down the throat of a surly boa constrictor whose appetite isn't what it ought to be?

Doctor W. Reid Blair, organizer and director of the Medical Department of the New York Zoological Garden, doesn't think anything of it. He's performed more than 1500 operations on wild animals during the last quarter of a century. He says he takes every necessary precaution and, pointing to a bottle of chloroform, that he takes no chances.

**Y**ET, Doctor Blair will tell you of the time he removed a wire that had become lodged in the hide of a buffalo, and how the crazed beast, freed of its ropes and lariats, gave a wild snort and made for him. He took that fence in nothing flat, the ungrateful buffalo thundering and bellowing a step behind.

Then there was the time when Doctor Blair operated on the infected foot of a prejevalski, which, if you don't happen to know, is a wild horse from Central Asia. Just as the delicate part of the operation was concluded, the animal gave one perfectly healthy kick and Doctor Blair flew through space, landing (happily for him) on a bale of hay.

It would be a ticklish job if anything ever happened to Khartoom, the Zoo's prize African elephant. This valuable beast is so vicious now that he never can be approached, and if he happened to get sick or break his leg or otherwise hurt himself, he would have to be shot. Khartoom would kill any man he could reach. He is 23 years old and stands well over 11 feet in height. And he will probably live to be 60. He has two cages,

with a great connecting door, so that he can be kept clean and free without being approached.

Popular fancy considers an elephant as husky and tough as his hide, impervious to bullets and quite immune to ordinary ills. Yet, curiously, the skin of an elephant isn't tough at all. It may resist rifle fire, but it succumbs to bacteria. Elephants have to be carefully watched, for they suffer frequently from eczema.

Elephants are subject to brain lapses, too, despite the fact that they are clever, patient, and willing. And that makes trouble for the doctors. Imagine a great big elephant tripping on a sloping runway, falling just two feet, and fracturing his thighbone. That preposterous accident happened at the Bronx Zoo a few years ago, and even Doctor Blair couldn't save the beast, worth \$4000. He had to be

Bears also need plenty of surgical attention. They are fighting constantly with each other and tumbling around on rocks and in pits. Recently a huge Alaska brown bear, in a vicious fight, drove one of his canine teeth (two inches long) through his upper lip. The animal was wild with pain and anger, and Doctor Blair and his assistants had to catch him, chloroform him, pull his lip down by strenuous traction, and then treat the wound.

**O**NE of Doctor Blair's most extraordinary operations was on a bear. A grizzly got a lumpy jaw, a growth something like that common to range cattle. The bear was in severe anguish and had to be coaxed

into a hospital cage to be chloroformed. Early in his work, Doctor Blair found that wild animals will respond to anesthetics more quickly when they are indoors. The difficult operation on the bear's jaw was successfully performed.

An African two-horned rhinoceros with a badly swollen cheek was found by Doctor Blair to be suffering from necrosis of the lower jawbone, caused by a decayed tooth. The animal was put to sleep (though the task was dangerous and one of his nostrils had to be stuffed to do it) and the bone was scraped.

**A** LION whose mouth kept him in agony was treated by Doctor Blair without an anesthetic. This beast had caught a bone in a molar tooth and was in a frenzy trying to dislodge the impediment with his clumsy paws. Doctor Blair got the lion to the front of his cage and managed to insert a pair of tongs in



Elephant Wears Surgical Boots

A little Congo elephant at the Bronx Zoo had the misfortune to fracture one of his hind feet. Treating the fracture was part of Doctor Blair's usual routine, but designing the pair of surgical boots was a noteworthy accomplishment and speeded the animal's recovery.



his open mouth. The lion fought and battled, beside himself—until Doctor Blair managed to get the tongs on the bone. The beast suddenly seemed to sense that here was a Samaritan, a benefactor who would slay his distress, and he kept quiet for a moment. Doctor Blair yanked. The bone came out. And the lion lay down and yawned, as though nothing out of the ordinary had happened.

**IT WOULD** make a charming commentary on our work," Doctor Blair told me, "if we noticed appreciation on the part of our charges for what we do for them. As a matter of fact, we don't see any response. Most of the animals protest loudly and vehemently. The monkeys act up something awful. The lions are very obstreperous."

It is true that an animal once treated submits to medical and surgical attention more easily afterward. There was an orang-outang who was a champion hospital addict. He was constantly looking for attention and was very agreeable about it.

The most unusual operation ever performed by Doctor Blair was on a great elk, an Altai wapiti or Asiatic elk, which had been in a terrific fight with another of his tribe. This animal had been gored so frightfully that 18 inches of intestines protruded from its side. By any ordinary standard, the animal should have been killed instantly, but Doctor Blair caught him, had him crated, washed the intestines, put them back in place, stitched the side with 14 interrupted stitches, and bandaged the wound. Daily dressings soon brought the wounded warrior back to health.

**ONE** of the most difficult operations performed by Doctor Blair was on a regal lioness, captured by the famous Buffalo Jones in Africa. When the animal arrived at the Zoo it was noticed she was surly and resentful. She would not



**Forcible Feeding as Practised at the Zoo**

When a snake is ill it will not eat, and the keepers feed it, stuffing the food down to the snake's stomach, which in this instance was 5½ feet from its mouth.

eat except at night, under cover of darkness. She sulked and would not permit an inspection.

Finally, after close observation, tiny drops of blood were noticed on the floor of her cage and it was deduced that her claws must have grown into the pads of her feet. Her nails had to be destroyed. But getting this proud lioness to an operating table was a real task, a problem for true ingenuity.

Now, the lion-house at the Bronx Zoo is very well equipped, and one of its modern improvements is an elevator, a fixed cage about 6 feet 6 inches long and 20 inches wide. Meat was placed in this elevator and the lioness was enticed into it after considerable difficulty. Once the lioness was trapped, a tarpaulin was placed over the cage, making it airtight and she was chloroformed from an atomizer pump and roped and bed. Her nails were removed.

The lioness then was placed in a stan-

lighted cage for convalescence, 18 by 14 feet, which opens on an outdoor well. She came to slowly. And what a racket she made! She roared and howled! The whole park resounded with her rage and anger! Sightseers ran up, but one look was enough. The lioness made for the bars of her well, and, though she hadn't a chance to get loose, that crowd made for the exits.

**THAT** lioness was well again in 10 days and lived to be 15 years old, a ripe age for a lioness in captivity. She died a year ago. And it's probably true that in the jungle she would have died sooner.

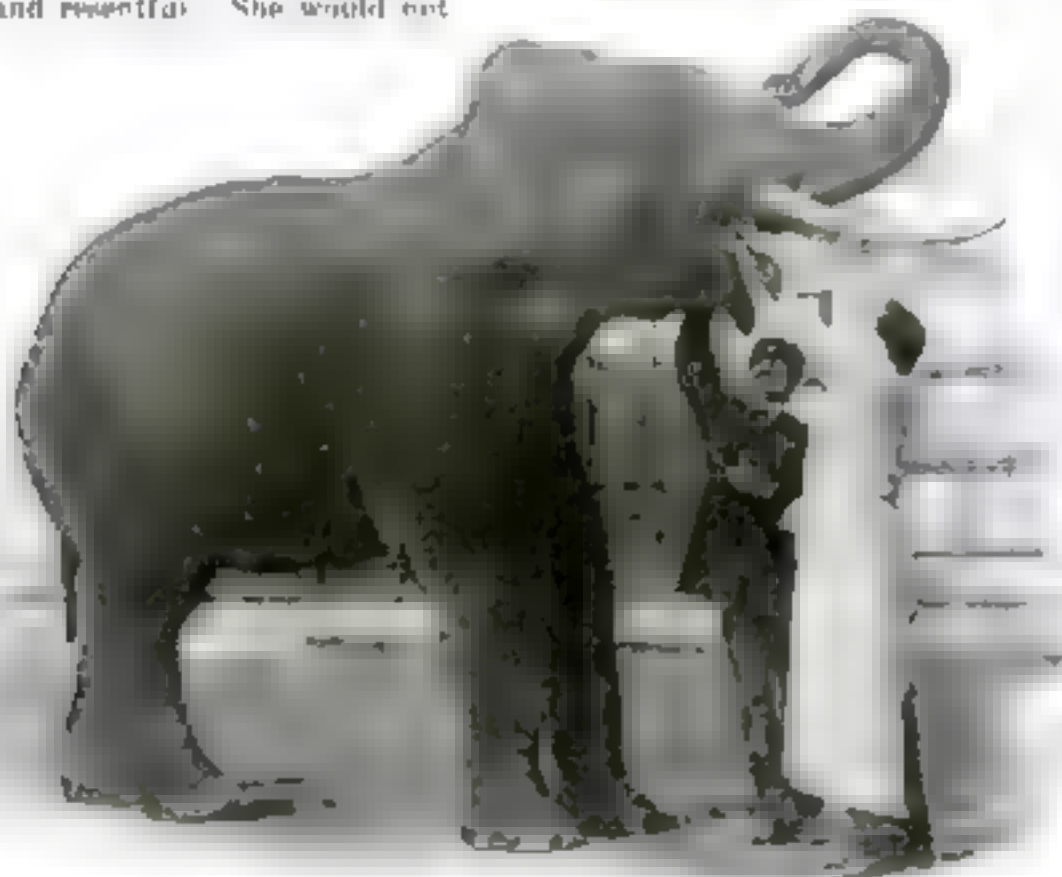
It is true that as a rule animals in captivity don't live as long as those that are free. But, on the other hand, some live longer, for the zoo provides the finest attention, gives balanced food on a strict diet, and affords protection against powerful enemies.

There's a Sambar deer, an Indian deer about the size of a European red deer, that is 23 this October and is stone blind. This sweet old lady, who has the unromantic name of Fatty, has presented the Zoo with 16 babies, and her keeper refuses to have her killed. Ordinarily, the Zoo wouldn't keep an animal not healthy, but rules are forgotten in Fatty's case. She feels her way around and her keeper guards her. A placard on her spacious cage tells the public a little about this old favorite.

**AN EXTRAORDINARY** operation on animals, though it is not uncommon on humans, was performed by Doctor Blair on the eyes of an Indian rhinoceros. This animal, a splendid physical specimen, came to the Zoo with two cataracts over each eye. Doctor Blair performed the needling operation, in which a knife is inserted in the eye and the capsule of the lens is ruptured in order to dilute the opacity. The operation is absolutely painless and is performed on human beings without an anesthetic, but the rhinoceros was given cocaine.

The operation was the easiest part. Preparing the patient for the operation

(continues on page 369)



**Jumbo Goes to the Dentist**

Unless an elephant runs amok, he is a great favorite in the zoological gardens, both with keepers and visitors. "Open, please," says the doctor, as he treats a bad molar.



# New Mileposts of Discovery

*Fascinating Achievements Mark the Progress of Science—  
Einstein Challenged—A Second Niagara Found*



**Makes Huge Vacuum Tubes Possible**

For inventing the first practical airtight seal between glass and copper and so making possible the construction of huge vacuum tubes used in high power radio broadcasting. William G. Houskeeper of the Bell Telephone Laboratories, recently was awarded the John Scott medal and a \$1000 prize by the city of Philadelphia. Mr. Houskeeper is seen holding a great 100,000-watt tube.

EVERYWHERE, every day, men with ideas are studying, experimenting, inventing, exploring the unknown, and giving the results of their efforts to the world. The sum total of their labors marks the advance of science. It is to help you keep pace with this steady, ever-changing progress that POPULAR SCIENCE MONTHLY presents here some of the month's most important discoveries and inventions.

## Will Einstein Theory Fall?

THE Einstein theory of relativity soon may fall, and we may have to look for another explanation regarding the mysterious movements of the universe. Professor Einstein himself has just admitted it. If results obtained recently by Prof. Dayton C. Miller at Mount Wilson Observatory are confirmed, he says, it means that the relativity theory does not hold.

For Professor Miller's results indicate the earth's motion through the ether. According to the relativity theory, it should never be possible for any one on earth to detect this motion. If all things in the whole universe—planets, stars, and ether—are moving at the same rate and in the same direction, the results of experiments on earth would be exactly the same as if all were standing still.

But if the earth and other bodies were moving through stationary ether, or at

different rates, then there should be a drifting of the ether in their paths that could be observed from earth.

Professor Miller first made his experiments from an underground chamber, just as Professor Michelson and Professor Gale of the University of Chicago have been doing in tests of the Einstein theory. Like them, he could detect no motion—evidence substantiating the Einstein theory.

Their results, however, possibly might be explained by "ether drag." That is, in some way heavy bodies, such as the earth, drag along a certain amount of ether in their motion, leaving the more distant ether unaffected.

To test this, Professor Miller repeated his experiment at Mount Wilson, which is about a mile high. And here he obtained the surprising results that may contradict the relativity theory. He found a marked effect that seemed to vary with altitude.

## Snapshots in Colors

A SIMPLIFIED method of color photography recently demonstrated in Paris, may hasten the day when we all can take snapshots that will register green trees and blue sky.

Instead of the old color photograph method, requiring three separate exposures, Roussieu (discoverer of the new method) found that he could get better results by a single exposure of three films placed one upon the other in the camera. Only a single plate needs to be developed.

The first film registers blue and violet, the second green, while yellow, orange, and red are registered on the third.

## Luscious New Berry

ONE of these days you will go to the grocery store and discover a new dewberry—one that is larger and

more luscious than any you ever have seen. It will be wine colored, somewhat darker and sweeter than the loganberry. It is more resistant to disease than the ordinary dewberry, and it is believed that the new fruit even may replace the popular loganberry on the Pacific Coast.

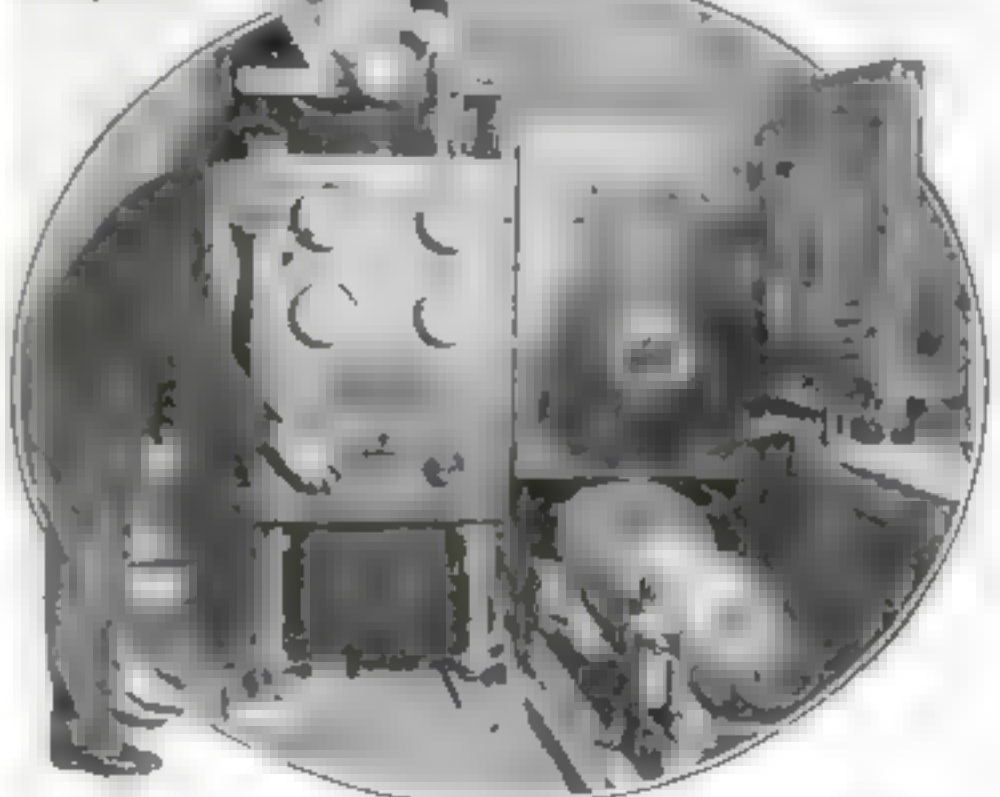
A Louisiana electrical engineer, B. M. Young, who breeds plants as a hobby, obtained the new fruit by crossing two varieties of dewberries. The United States Department of Agriculture considers the size and quality of the fruit so important that it is propagating stock so that the new variety may be released to the public through nurseries.

## Another Niagara Found

A WATERFALL as great as Niagara in the midst of a barren desert was one of the sights seen by Mrs. Agnes Chase, botanist of the United States Herbarium, who has just returned to the United States after seven months in the wilds of Brazil. Looking for peculiar species of grass, she went high into the eastern plateau where the land has become a desert through overgrazing. She climbed the highest peaks in Brazil east of the Andes.

The man who revealed to the modern world the ancient Maya civilization that flourished before the time of Christ in Central America, has come home. Edward H. Thompson has spent 20 years resurrecting Maya ruins. His greatest single feat in a list that sounds like captions to a movie thriller, was diving to the bottom of the Sacred Well at Chichen Itza, Yucatan.

**Submarine Telephone**



This undersea telephone transmitter is part of a remarkable new instrument that makes under water telephone communication between submarines possible. It is the invention of Dr. Harry C. Hayes, U. S. Navy physicist, inventor of the sonic depth finder and other important submarine signaling devices. He is shown demonstrating the apparatus.



There, 80 feet under water, he found the bodies of 90 sacrificed maidens, together with priceless quantities of jade, gold, and incense.

The water in the well was only 40 feet deep, but below it was 40 feet of mud. Mr. Thompson went to Boston and got a job scraping the bottom of deep-sea vessels in a diving suit, then, with knowledge of this work, he returned to Yucatan. By throwing logs down into the well, he figured out the spot where the treasure and maidens must have fallen, then had the mud dredged from that part. After that came the dangerous diving, which resulted in the ultimate recovery of the treasure.

### Radio Fights Forest Fires

**A**RRANGEMENTS are being made this year to use radio over the whole Western forest area to aid in fighting and preventing forest fires. By means of instruments that register humidity very exactly, it is possible to forecast with accuracy the sections where fires are likely to occur. With warnings broadcast, firefighters can be on the spot ready to prevent fires or control them when they break out.

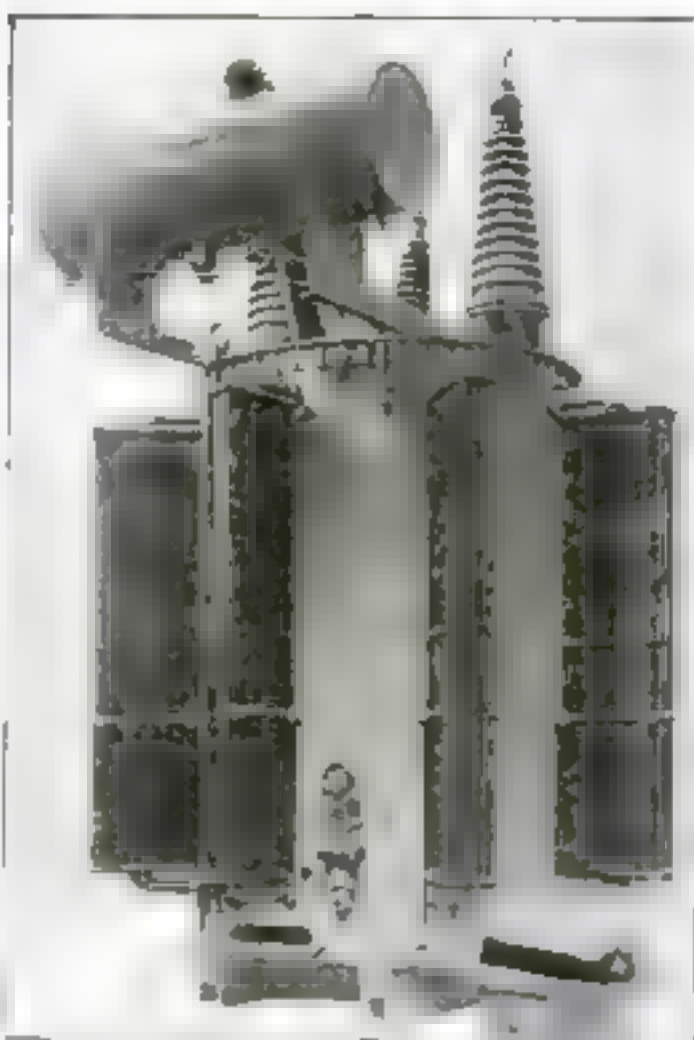
Tall trees are used as poles for radio antennae.

### Are We All Abnormal?

**E**VERY one of us is abnormal at some time or other, according to a recent statement of Dr. George W. Henry, a New York psychiatrist. What we call a normal person is one who possesses the average characteristics of a great variety of individuals, he points out, but along with these common characteristics there are often many queer ones.

To bear this out, Doctor Henry calls attention to peculiarities of famous men commonly regarded as normal.

Beethoven, the composer, would use several pitchers of ice-water to wash his face and hands splashing it about so that it leaked through to the ceilings below.



Forty Years of Progress in Transformers



Compare the modern transformer above with the first transformer built by William Stanley in 1885 indicated by arrow and shown in lower picture. The modern unit weighs 1000 times as much and gives 10,000 times more power.

Chopin was so extremely nervous that he was tormented by such trifling things as a wrinkle in a rose leaf.

De Quincey, the writer, had hallucinations and set fire to his books and papers, while Balzac believed that his

writings would reform the world. One evening, having put on a new dressing-gown, the latter wanted to go into the street with a lighted lamp to excite the admiration of the public.

### Defense Guns Prove Deadly

**T**ARGETS only five feet wide and 19 feet long, towed behind airplanes traveling 70 miles an hour at a height of 8000 feet, were comparatively easy marks for the United States Coast Artillery anti-aircraft guns in a recent test.

The recorded percentage of the hits scored was 5.8, which meant one hit for each 18 shots fired. That is about six times as many hits as were claimed for the firing at the end of the World War, say government officials.

### Circles Britain in Five Hours

**F**LYING at an average speed of 151 miles an hour, Captain F. L. Barnard recently won the "around Britain" race for the King's Cup in England. It took him five hours, 17 minutes flying time to make the circuit of 804 miles up the east coast of Britain, across Scotland, down the west coast and across the island to the starting point. He used a 395-horsepower plane. This was Captain Barnard's second victory.

### Makes Old Hens Lay

**A**N OLD hen for chicken pie. It may be difficult to get one for this purpose if an experiment made by Dr. F. A. E. Crew of Edinburgh University becomes well known. By administering thyroid to chickens he claims he can make hens lay as long as they can cackle.

Some hens that had laid only 25 eggs in the previous four years laid more than 100 eggs during the year that they were given thyroid, he found.



Reconstructing the 30-Foot Tail of an 80-Foot Dinosaur

Professor Charles Gilmore, curator of the National Museum, Washington, D. C., is seen here at work reconstructing the tail of a huge dinosaur discovered by him at the Dinosaur National Monument in Utah in 1923.

The tail is 30 feet long and is composed of 32 vertebrae. The length of the complete animal was 80 feet. Professor Gilmore expects to complete the work of restoration of this prehistoric reptile sometime in 1927.



# Safety at the Switches

*Dangerous Freight-Yard Jobs Now Performed by Machines*



**The Old and New Ways of Switching Cars**

Above: Remarkable new automatic braking and switching mechanism installed at Gibson, Ind., showing control tower. At the sides of the rails are pairs of movable bars, driven by compressed air, that grip the car wheels. Right: The old and dangerous method of hand braking.



**Automatic Emergency Stop**

An electro-pneumatic apparatus that "throws skates mechanically to stop a wild-running freight car now is contained in a box beside the track, ready for emergency.

of levers, these pairs of bars can be closed like a vise on both sides of all wheels passing between them. The retarder is so powerful that a car can be stopped and held on the steepest part of

the incline whenever necessary.

Two hundred and forty feet of retarders arranged in seven units with space between, give the first operator control of movements down the incline. Forty-four other units distributed about the yards are operated by four other men.

An ingenious auxiliary of the retarder is a "skate throwing machine" to halt any car running wild. By the movement of a lever in a control cabin, an electro-pneumatic device places a heavy cast-iron wedge on the track to bring the unruly car to a stop. The former method of "throwing skates" by hand was extremely dangerous, resulting in many deaths.

**P**ITCHED from the icy top of a freight car, or crushed between cars in doing his work, a railroad switchman's job is one of the most dangerous, and casualties have been appalling. For this reason a new mechanism installed in Gibson, Ind., which switches and controls the cars automatically, is attracting wide attention.

Replacing an army of switch tenders and car riders, a few towers have been erected in the railroad yards. In these elevated cabins, operators work electro-pneumatic switches, while below freight cars slide toward any one of 30 destinations.

Hump switching, the most approved method of assembling cars for given destinations, is retained in the new

system. Trains to be classified are pushed up to the crest of a hump, where each car, or group of cars coupled together, is uncoupled and allowed to run by gravity down a short, steep grade.

By the old method, as the cars raced down the incline, each had to be mounted by a rider who regulated the speed with hand brakes.

The new switching device, invented by George Hannauer, vice president of the Indiana Harbor Belt Railroad, is called a "car retarder." It consists of movable bars from eight to 10 feet long, assembled in units of from 32 to 40 feet, in pairs on either side of each rail. By means of a compressed-air cylinder and a system

## Ingeniously Simple Water Turbine Develops Cheap Power

**E**CONOMIC utilization of the energy represented by the flow of water in rivers and other water channels always has been a problem. Where the angle of descent, the drop, is great, or where natural falls interrupt the flow, the solution of the problem by dams and artificial falls or by the construction of sluices regulating the volume and direction of the falling water, is comparatively simple. But in nearly all cases the engineering work involves the expenditure of money, often entirely out of proportion to the results obtained.

Recently Eduard

Suess, an engineer of Vienna, invented a water turbine of a new type, simple of construction, inexpensive, and developing

a high degree of power for plant use.

The Suess turbine consists of a slightly conical housing, with a built-in four-bladed propeller. The turbine is submerged in the stream and is securely anchored in position, with the smaller opening of the housing pointing against the current. The water, entering through the smaller opening and passing out through the larger, relieves the propeller of stemming counter pressure and greatly increases its power. The Suess turbine, being submerged entirely and resting on the bottom of the river, does not interfere with navigation.



Powerful water turbine invented by Eduard Suess, Vienna engineer



# Human Eye Outdone by New Color-Sorting Machine

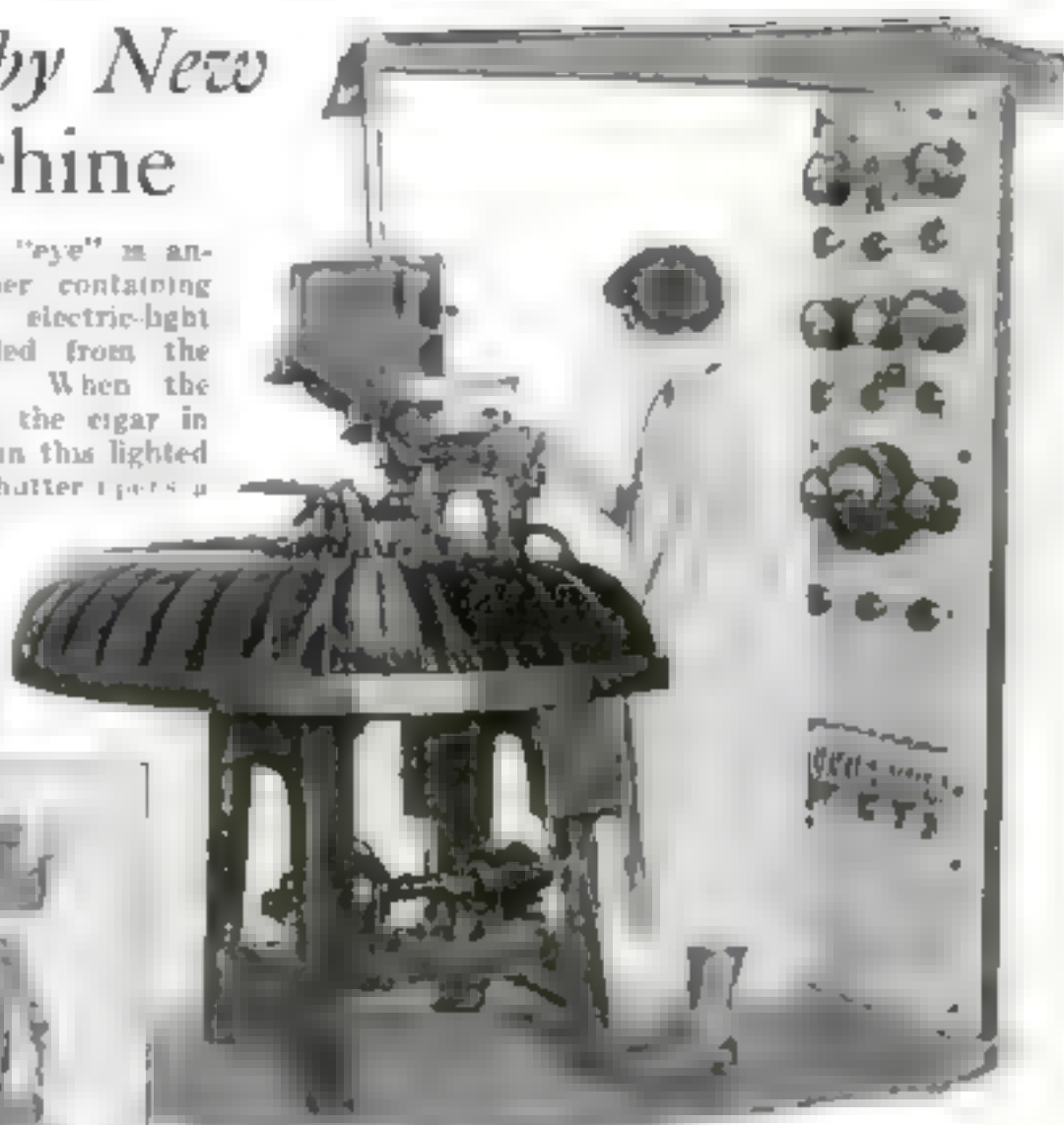
**A**FTER five years of patient experimenting there recently has been perfected a remarkable machine that automatically separates cigars into 30 different groups, depending on the shade of the wrapper.

The machine consists of a finger that picks up each individual cigar, a photo-electric "eye" that measures the color, an amplifying panel that boosts the infinitesimal current generated in the eye, a switching ammeter that actuates the mechanical sorting mechanism, and a set of 30 compartments arranged around a common center into which the cigars are passed fully.

The cigars are fed into a hopper mounted above and to the side of the photo-electric cell. From the bottom of this hopper an ingenious split finger picks the cigars one by one with meticulous care and carries each to the bottom of the "eye" tube.

The "eye" is a tube with two terminals connected with a battery. One terminal is enlarged within the tube and heavily coated with potassium. The entire tube is covered by a lightproof case, and in the darkness no current flows between the two terminals. Light, however, activates the potassium-covered end and permits current to flow

Below the "eye" is another chamber containing four small electric-light bulbs, shielded from the tube above. When the finger places the cigar in position within this lighted chamber, a shutter opens a slit in the covered chamber above and only the light that is reflected



Cigar Color-Sorting Machine in Operation

from the wrapper of the cigar is permitted to act upon the tube. The actual color of the cigar, then, determines the amount of current permitted to flow between the

two tube terminals. And, since every color reflects a different amount of light, the machine's color-sorting abilities depend on its detection of varying currents.

## Remarkable Bullet-Proof Gas Tank for Airplanes

**U**NDoubtedly the greatest menace to the pilot of the fighting airplane is the danger of fire caused by an enemy bullet's penetrating the gasoline tank. Even if a bullet hole

in the tank does not immediately burst into flames, the gasoline will flow out and the aviator will be forced to land.

Mario Garagnani dei Pescara, an aviator during the war, has just patented a gasoline tank that, he claims, will overcome these difficulties. It consists, really, of two tanks, one inside the other. Both inner and outer shells are made of fiber one-half inch thick. In addition, there is a one-fourth-inch layer of granulated sheet cork and a one-sixteenth-inch layer of sheet rubber on the outside of the inner shell, and a lining of the same kind on the inside of the outer shell. This arrangement brings the two layers of rubber in contact with each other.

The operating principle upon which the tank functions consists of rotating the inner shell a few inches each time a bullet penetrates the tank. Castor oil is used as a lubricant, since it has little deteriorating effect on rubber.

On the end of the tank is located the mechanism that automatically rotates the inner shell when a bullet strikes the tank. The expansion of the fluid in the tank, caused by the rapidly moving projectile, indirectly throws electrical switches that engage two clutches and these transmit power from a flexible shaft

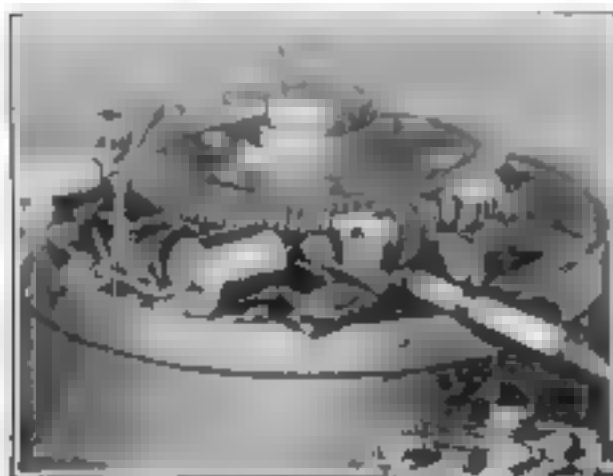


Greater Safety for War Pilots

The inventor adjusting the flexible shaft that transmits power from the airplane motor to the mechanism that operates his bullet-proof gas tank

connected with the motor of the airplane to the worm gear that rotates the inner cylinder. The rotation places the hole in the inner tank in contact with the wall of the outer tank and this stops the leakage of the fuel.

The tank was tested recently by the United States Army Air Service and it is stated that it withstood not only the terrific shock of the .50-caliber machine-gun bullets, but that the controlling mechanism functioned perfectly and stopped the leakage that ordinarily would have drained the tank. A means is provided for automatically disconnecting and dropping the tank from the airplane.



The Controlling Mechanism

When a projectile strikes the gas tank it causes an expansion of the gas. This expansion starts the mechanism which revolves the inner tank enough to close the newly made hole. Note the wheel that turns it.







### New Army Gas Mask Has Phone for Field Work

**G**ROTESQUE is the telephone gas mask, developed recently by the U. S. Chemical Warfare Service. It is designed chiefly for use by advance posts during attack, that the wearer can telephone information to stations in the rear.

The wearer is said to be heard clearly even in the heaviest firing. The telephone connection is inserted near the mouthpiece. When the mask is adjusted, the wearer is unable to speak to any one near by. His only means of communication is by telephone.

### Scientist Uncertain If Tortoise Is Deaf or Stupid

**T**ORTOISES are either deaf or stupid. Most water snakes cannot hear at all, but land snakes often have acute hearing. These interesting conclusions were reached by Ryo Kuroda of the College of Niigata, Japan, after extensive experiments with reptiles.

To test the tortoise's hearing, scraps of meat were laid on a broad copper plate. When the tortoise attempted to snap up a bit, a bell was rung and at the same time an electric current was passed through the plate. The idea was that if the tortoise could hear, it would soon associate the ringing of the bell with the shock. But repeated experiments showed that the ringing of the bell meant nothing to the animal. It snapped for the food, anyway, and was just as surprised by the shock each time.

### British Scientist Says Men Can Live for 150 Years

**A**T THE mere cost of 12 cents a head, the span of life may be extended to 150 years, claims Sir Ronald Ross, the British scientist, whose researches have led to cures for malaria and sleeping sickness. His idea is that 12 cents from the pocket of every Englishman spent in scientific research would result in a new medical knowledge that would keep germs and old age away so that man easily could live 150 years. He thinks that the allotted span of threescore years and ten should find man in the prime of life. We live curtailed lives, he says, because we are the prey of countless germs.

### Newest Umbrella Folds into Thin Ten-Inch Roll

**W**HEN the shower is over, you roll up the umbrella and put it in your pocket. The roll is only 10 inches long and 2½ inches in diameter.

Frank J. Pugel, of Pueblo, Colo., the inventor of this ingenious device, is a true friend of the man who hates to carry an umbrella. The ribs of the umbrella are hinged in the middle so that the outer half of the top folds back, while the inner half folds in like the ordinary umbrella. The handle telescopes.

Opening and closing the umbrella is done by screwing or unscrewing the handle a few turns.



How umbrella looks opened and closed

A BILL has been proposed in the California Legislature requiring all persons who make camp fires to carry a license. This is intended to stop forest fires, which have caused such heavy losses of valuable timber every year.

### Government Tests Beef by a Chewing Machine

**T**HAT tough beefsteak—would it afford you any satisfaction to know exactly how tough it is? Anyway, the United States Bureau of Standards is interested in knowing just what is expected

of a man's teeth when he is served broiled, baked, or boiled Texas steer.

The photograph at the right shows a machine devised by the bureau to twist or mechanically chew beef while an automatic counter on the machine records its efforts.

The Bureau of Standards has not advertised this machine as a household device, yet there may be a demand for similar machines from the long-suffering



### Neck-Shaped Air Pillow Assures Travel Comfort

**S**HAPED to fit around the neck, a new air pillow, used as a head rest, is suited especially to the needs of travelers. In spite of the pitching of the boat on shipboard or the shaking of a train, a person can enjoy sleep with a cool pillow such as this that stays in place. It can be used, also, in automobiles or for invalids.

The pillow, when folded, may be carried in a coat pocket or handbag. The tapes are supposed to be drawn across the chest and fastened about the waist.

### Cannot Tell Sex of Chicken by Shape of Egg

**S**OME declare that long, slim, heavy eggs produce roosters, while the small and shorter ones become pullets. The U. S. Department of Agriculture says that you can tell nothing about the sex of a chicken from the shape, size, or weight of the egg. You can tell it only after seven or eight days of incubation of the egg.

Experiments have determined that the greater the number of eggs a hen lays before being put into the breeding-pen, the larger will be the proportion of females produced by her eggs.



U. S. Government set up testing toughness of meat by machine that would tell how much a man's teeth should be able to chew of "prime" meat





### Novel Gravity Scales for Weighing Light Mail

**T**HIS new scales for weighing letters and other pieces of mailable matter is operated entirely by gravity. There are no springs to become weak with age and give incorrect weights.

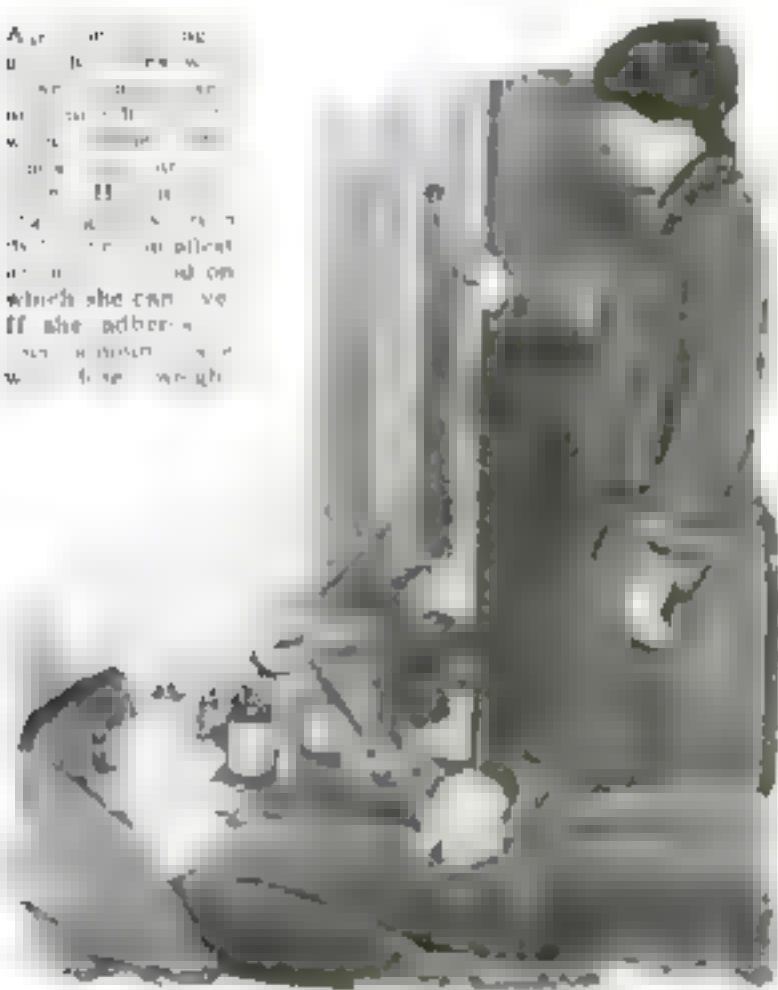
In operation, the letter is placed on the pan and the cylinder weight is moved along the rod until a balance is struck. Then the weight is read from the measure below the cylinder at the point where the line is cut in the cylinder.

### Cardboard Is Used for Kitchen Utensils

**R**ECENTLY invented and patented in England is a process by which cardboard pressed into the shape of various kitchen utensils can be so treated as to render it waterproof and acid-resisting. The cardboard kettles and saucepans are dipped into a solution of asphalt, resin, shellac, and spirit and allowed to dry in the air. It readily can be seen that the process offers wider possibilities than mere kitchen utensils.

## Stout Co-Eds Grow Slim by Machinery

A girl who is stout can reduce her weight by using a machine which tells her how much food she can eat and how much exercise she should take. The machine is a small box with a dial and a tube which is connected to a rubber mouthpiece. The girl breathes into the tube and the dial shows the amount of oxygen consumed. The machine also has a small scale for weighing food.



### Hanging Weight Holds Papers Securely on Spike File

**W**HEN the electric fan is running or a gust of wind comes tearing through the open windows of a busy office, papers are likely to blow off the spike type of letter file.

J. M. Milling, a telegraph operator at Dallas, Tex., got tired of chasing telegrams that blew off his desk whenever he had the windows open or the electric fan turned on, so he invented the new letter file illustrated.

A weight suspended on a chain, hanging from a crosspiece above the spike, prevents the papers from blowing away and yet it does not obstruct the sharp point of the file when papers are to be slipped on.

THE new letter file is a simple device which can be made from a piece of wire and a weight. It is a simple device which can be made from a piece of wire and a weight.



CANADIAN sugar, which comes from the leaves of the Douglas fir-tree, is now being studied intensively by Prof. John Davidson, botanist of the University of British Columbia. This sugar is an exudation from the needles of the fir, and sometimes hangs from the tips of the leaves. It is exceedingly sweet.



### Adjustable Apparatus Gives a Straight-Line Bob

**P**ERHAPS not quite as good, but almost as good as when the barber does it. A device has been invented to help the mother make her children's home hair bobbing look more professional.

A metal cage fits on the head like a cap. It may be adjusted with a screw in the middle to the length of hair wanted. Follow the lower edge of the bottom band with the scissors, and a perfect bob, it is claimed, will result. The apparatus is also a time-saver, for this method of cutting takes only a few minutes.

### Marvelous "Brass Brain" Has 15,000 Separate Parts

**T**HE "brass brain," a device that can predict what the tides will be in any seaport in the world at any time—for tomorrow or 100 years from tomorrow—is in constant use in the laboratory of the Coast and Geodetic Survey, in Washington, D. C.

The machine is said to do the work of 60 mathematicians, and actual check on the predictions proves it to be nearly 100 per cent accurate. At present the "brass brain" is being used to predict the tides at 85 ports all over the world. As a result of these predictions, the department is able to tell two years in advance what the high-water mark will be at 3500 other ports.

The idea was conceived by R. A. Harris, Chief Mathematician of the department, and the plans and construction were under the direction of E. G. Fischer, M.E. It took 15 years to perfect, and its name is derived from the fact that practically all of its 15,000 parts have been made of brass.

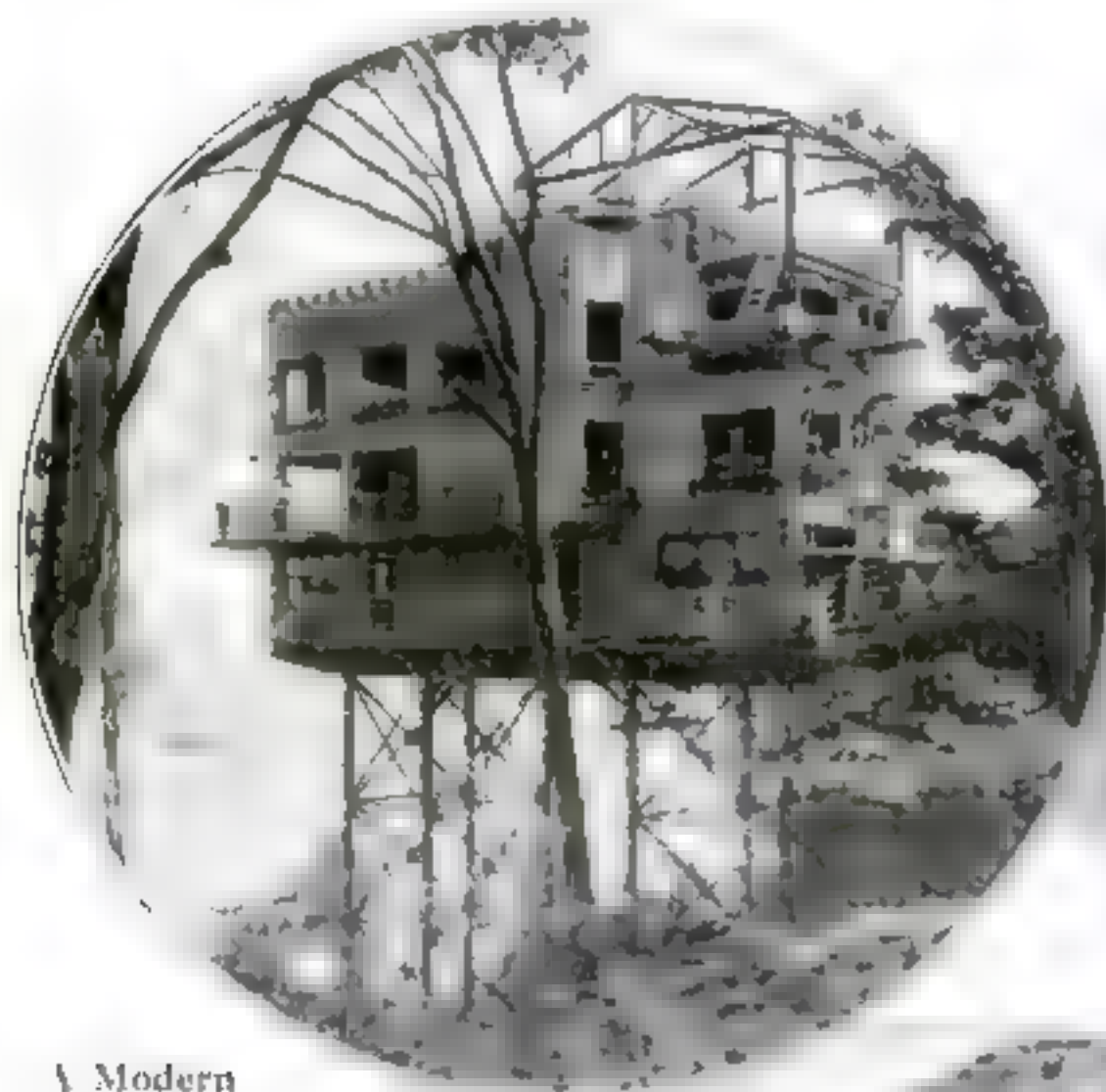
Even the extra day in Leap Year is given consideration by the wonderful "brass brain."

### New Bank-Teller's Cage Is Robber-Proof

**W**HAT is claimed to be a bullet-proof, gas-proof, and robber-proof bank-teller's cage, was invented recently by H. P. Grohn, a mechanical engineer of Chicago. The cage is made of sheet steel. A series of mirrors, a speaking-tube, and a patented lock drawer are designed to protect completely the bank employee and yet enable him, while dealing with legitimate customers, to maintain a sharp lookout on all sides for robbers.

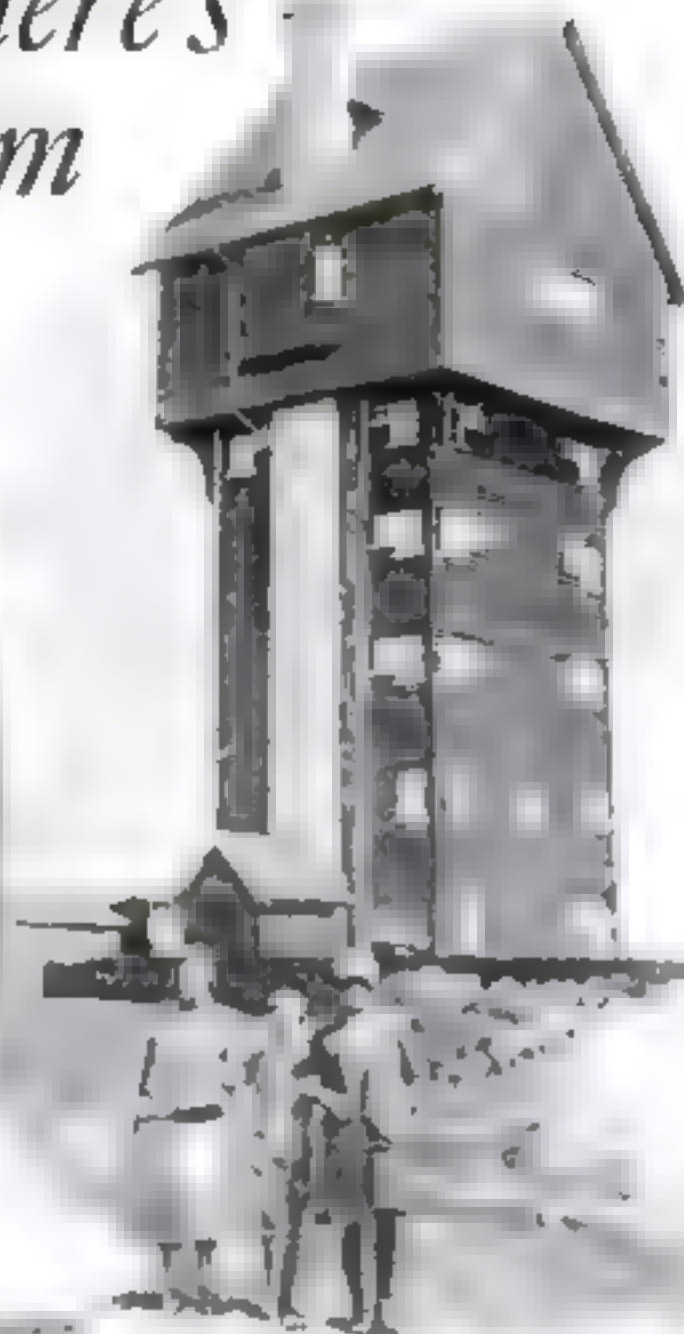


# Queer Homes—*There's No Place like Them*



## A Modern "Tree Dwelling"

The primitive tree house has been replaced by a modern one. The modern tree house is built of steel and is supported by a steel skeleton. It is high in the air, overlooking the Hudson River, and when finished will provide an unusual amount of light and fresh air.



## Home in a Water Tower

A water tower that stores 10,000 gallons of water has been converted into a home. The tower is built of steel and is supported by a steel skeleton. It is high in the air, overlooking the Hudson River, and when finished will provide an unusual amount of light and fresh air.



## Comfort in the Desert

By tunneling into a mountain and constructing most of his home under the earth, a Borah, Calif., resident finds protection from intense heat.



## Its Roof Is a Parasol

For protection from the hot sun, this emergency hospital building at Needles, Calif., carries a parasol in the form of a second roof set a few feet above the regular roof. The intervening air space serves as insulation, keeping the house cool.

## A Seaside Boat Cottage

At Aldeburgh, England, a ship recently was called into service to help solve the housing problem, as shown at the left. A second story was built above the hull, with shingled exterior and a tin chimney.



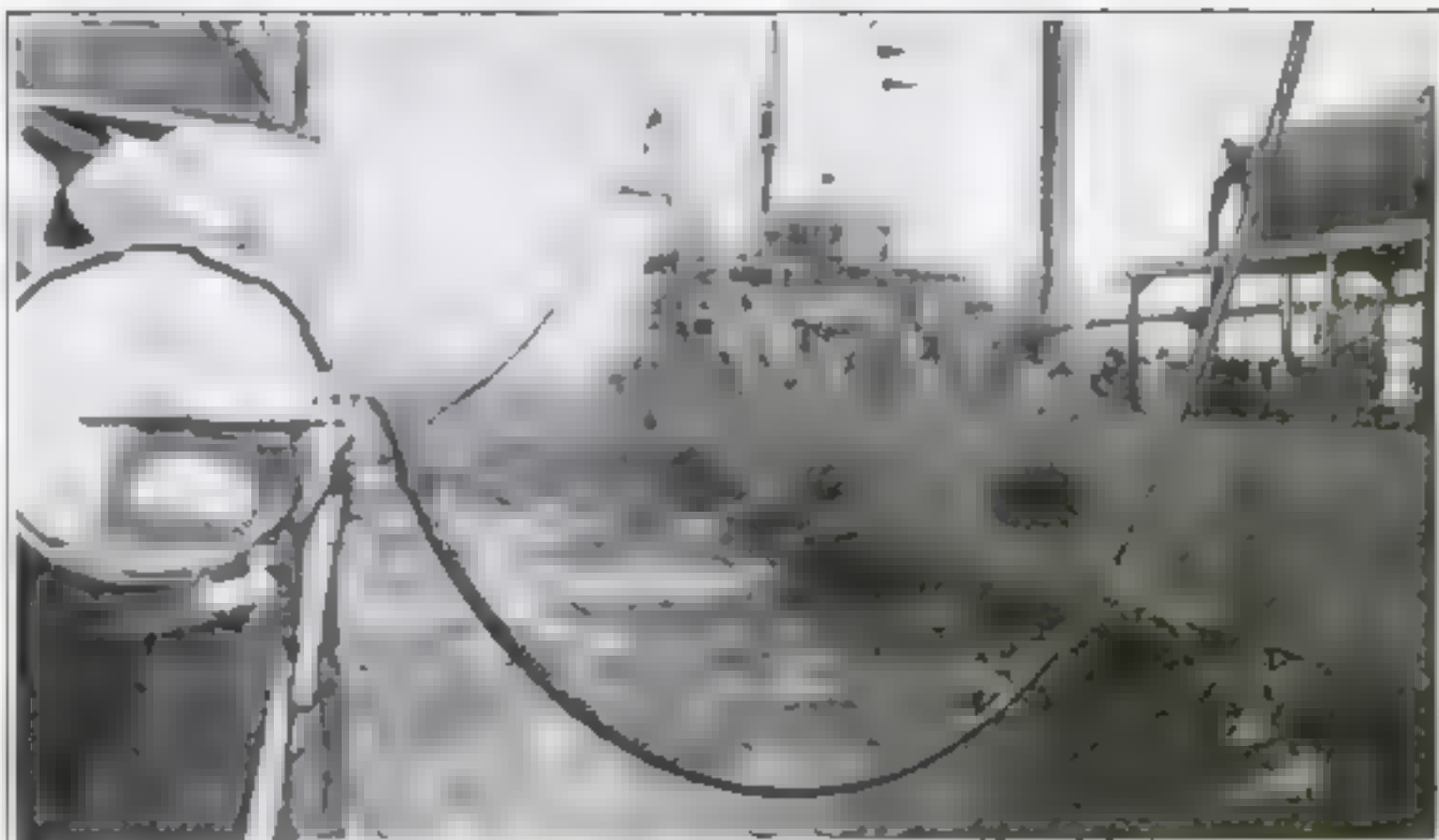


# Where Science Goes Down to the Sea

*New Wonders of Marine Engineering and Invention*

## A Service Station for Ships

No longer need Uncle Sam's warships hurry to shore to replenish their fuel supply. To-day there are filling stations along the ocean highways, and as there are service stations along country roads. These ocean stations are places where warships and merchant vessels can be refueled. The picture shows a S. S. *Orbita* at sea, taking fuel from a tanker through a long hose stretched between the two big vessels.



## Radio for Lifeboats

Under a new British law all passenger ships must carry at least one radio-equipped lifeboat. The above picture shows one of these boats with antenna masts on the S. S. *Orbita*. It can send messages 100 miles.

## Model Electric Yacht Equipped with Radio

Electric lights and other part of the elaborate equipment of an electrically driven yacht built by C. B. H. Inc., of Brooklyn, N. Y. shown below. The craft is equipped with a power system of sealed dry batteries.



## Lifting the Majestic

A world's record in weight lifting was made recently when the huge 60,000-ton floating drydock at Southampton, England, lifted the great Atlantic liner *Majestic*, weighing 56,551 tons, high and dry, as shown.



## Device Limbers Pianist's Hand

**M**AKING fingers supple by machinery is a new and royal road for pianists, said to do away with hours of tedious finger exercises. A Frenchman has invented a machine for limbering up the muscles of the fingers.

The natural tendency is for all fingers to work together. To counteract this, an apparatus has been devised that makes every finger move separately. Five minutes of machine exercise, the inventor claims, is equal to half an hour of technique practice.

Light pressure of thumb-screws holds the fingers in place in sockets. An eccentric cam makes the fingers move in various ways entirely contrary to instinct; another machine trains in octave spreads.



How fingers are held on limbering machine

## Diesel Engine Supplants Mule in Newest Canal Boats

**T**WO low, oddly shaped boats have been put in operation between New York and Duluth by way of the New York Barge Canal and the Great Lakes. Instead of the familiar snub-nosed prows of the old canal boats, the new ones are pointed at the front like torpedo boats. The hulls are constructed entirely of steel and the pilot house is placed exactly amidship.

From a distance the canal boats look exactly like giant submarines just coming to the surface. They are nearly three times the length of the old-fashioned canal boat, but retain the same width and low decks.

They are driven by Diesel engines, making 10 or 12 miles an hour, nearly five times the speed of the mule-drawn canal boat. A large section of the hold is equipped with refrigerating apparatus.

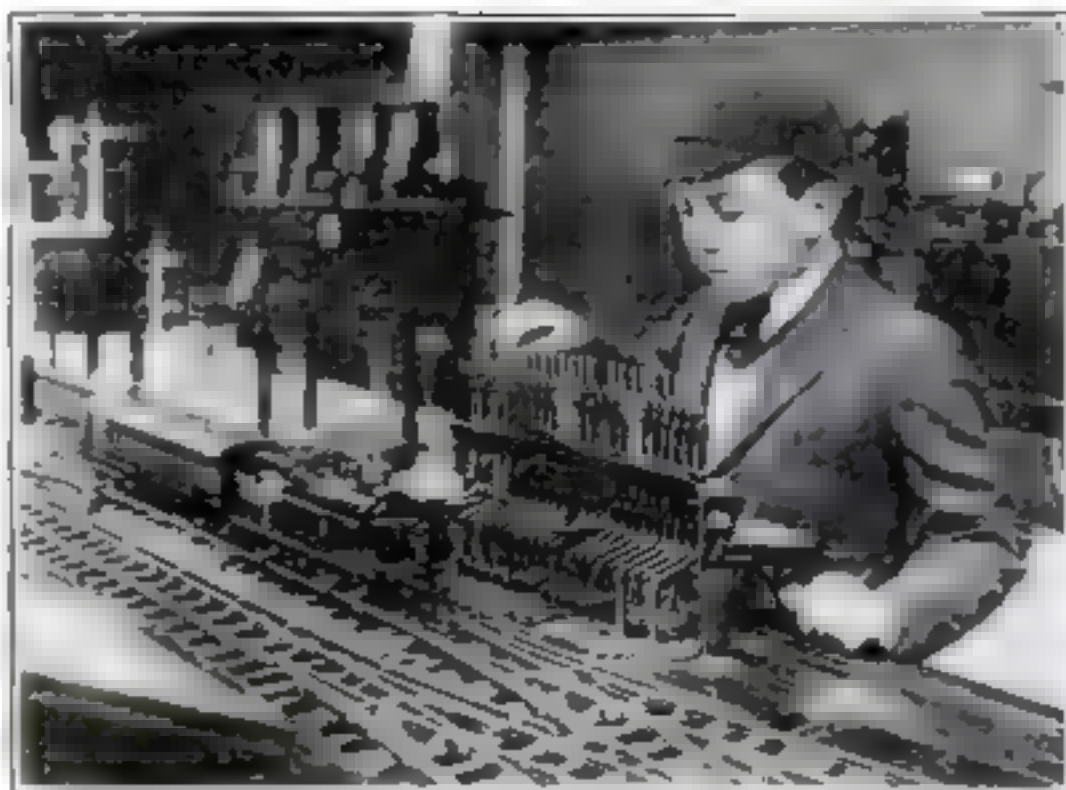
## Movie Star Wears a Watch in Her Shoe-Buckle



Watch is set in ribbon of slipper

**"H**ER feet kept time as the music played." There is now a more exact meaning for that phrase since a watch found a place in shoe-buckles. The one illustrated is a tiny Swiss model worn by a famous movie star.

A question suggested by this unusual way of using a timepiece is: What happens to the watch when the lady's feet are stepped on?



## Controls Train 300 Miles Away

**B**RITISH railroads, as a feature of their one hundredth anniversary, are demonstrating at the British Empire Exhibition at Wembley the most modern methods of control and various new signaling devices.

Electric lights on a control board indicate the progress of trains on 300 miles of line. The photograph above shows a signaling installation model of train-control methods as used in the British Empire today.

ONE hundred new flowers were brought to the United States recently when Dr. Francis W. Pennell, of the Academy of Natural Sciences, Philadelphia, returned from an exploration trip to Chile and Peru. They are all species of the foxglove, snapdragon, and lady-slipper family.



## Bottle Lock and Key Save that "Pre-War Stuff"

**A** BOTTLE under lock and key is not a new thing. But in this instance, the lock is not on the cupboard, but on the bottle itself. The butler or friend who would help himself to the contents without the owner's permission, is foiled.

Only the owner possesses a key that fits the lock and that goes on his personal key-ring. Not a drop of the beverage escapes without his knowledge.

NEWSPAPER files usually last about 20 years. The New York Public Library now has each newspaper sheet pasted between tissue-paper, which should prolong the life of the file about 100 years.

## Model Eiffel Tower Is Made of 11,000 Toothpicks

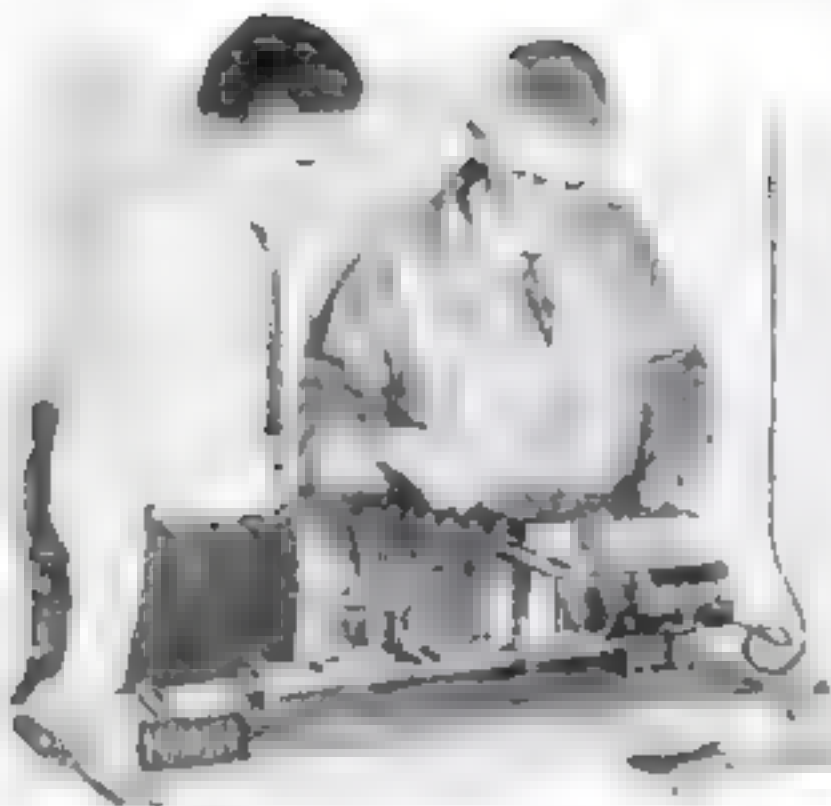
**E**LEVEN thousand toothpicks and 300 hours of time were put in this unique model of the famous Eiffel Tower in Paris. The only tools that Meyer Stein, 19 years old, of New York City, used in making it were a pot of paste and a pair of tweezers. Each toothpick had to be handled singly.

The young model-maker is a student at the New York College of Dentistry, which may account for his choosing toothpicks for building material.



Each toothpick of this beautiful model had to be put in place separately with tweezers





## A Portable Machine-Shop

WHEREVER there is an electric light socket, the handy man can have a power workshop. Sawing, buffing, lathework, grinding, drilling, polishing, and cleaning can be done with this new compact metal and woodworking outfit.

A power lathe bolted to a platform is operated by a simple back geared motor. Stocks 12 inches long and bowls or candle-stick bases as large as six inches in diameter can be turned on the lathe. Holes may be drilled in steel up to one-fourth inch in diameter and in wood up to one-half inch.

The outfit has a metal cover and may be carried to the job.

THIRD-DIMENSION motion pictures, ones that have depth effects as well as width and height, are produced by a new moving-picture camera exhibited in Chicago.

## Famous Violinist Brings a Unique Cane from Europe

WHEN Jascha Heifetz, the famous violinist, returning recently from a trip to Europe, walked down the gangplank of a steamer in New York, he carried a curious cane. It had the shape of a heavy walking stick, but it had strings like a violin and actually could be played.

It was a souvenir from abroad that the artist had "picked up," as the tourists say, and for which he had paid \$400. Mr. Heifetz was delighted with the unique instrument, and said its tone was really not at all bad.



Jascha Heifetz and his new violin-cane



## Smallest Lighthouse Model Is Made of War Waste

MADE by a sailor, this unique model lighthouse is accurate in every detail. Daris Huisman completed it recently for the United States Shipping Bureau, after working on it nights for three years.

It is made of 36 shells collected from the battlefields of France. The lighthouse is electrically lighted and is equipped with a motion-picture projection machine light that casts a beam that may be seen for quite a distance. Looking through the little windows one can see a kitchen and other living-rooms of the lighthouse, completely furnished.

Butter that keeps longer is being made in Holland by churning it in the presence of carbon dioxide. The air that is naturally in a churn is drawn out and replaced with carbon dioxide. Part of this works into the butter and remains there a long time, keeping out air, which is the chief cause of deterioration. The increased expense of this method is said to be small.

## Where the Diver Met Her Shadow

MOST unusual was the photograph taken recently at the opening of the largest swimming-pool in the world, built at San Francisco. The honor of the first splash was accorded to Miss Mavis Cochrane, a co-ed at the University of California. When Miss Cochrane dived, a murmur of admiration arose at the graceful flight. Only a few near-by spectators saw what the photograph shows—a reflection so clear that it had the appearance of another diver beneath the water meeting the real diver above.

The new pool is 1000 feet long, 150 feet wide, and requires more than 6,000,000 gallons of water. The cost of the pool and building, which has 750 dressing-rooms, was \$100,000. It could accommodate easily all swimming contestants in the Olympic Games.



Unusual reflection of a diver

A new Cunard liner at the clocks are driven electrically and controlled by a master clock. This has a chronometer escapement instead of a pendulum.

## Bicycle-Scooter Is Newest Plaything for Children

THE little fellow who wants a bicycle but his dad will be delighted to know that a new plaything has just been put on the market for him. It is a scooter—

...a rubber tire, a spring bicycle seat and handle-bars. The rear wheel is free, while a hand brake is provided for the front wheel. An adjustable seat permits the bike to grow with the child. Another model, keeping up to the minute in style, has balloon tires and a parking stand.

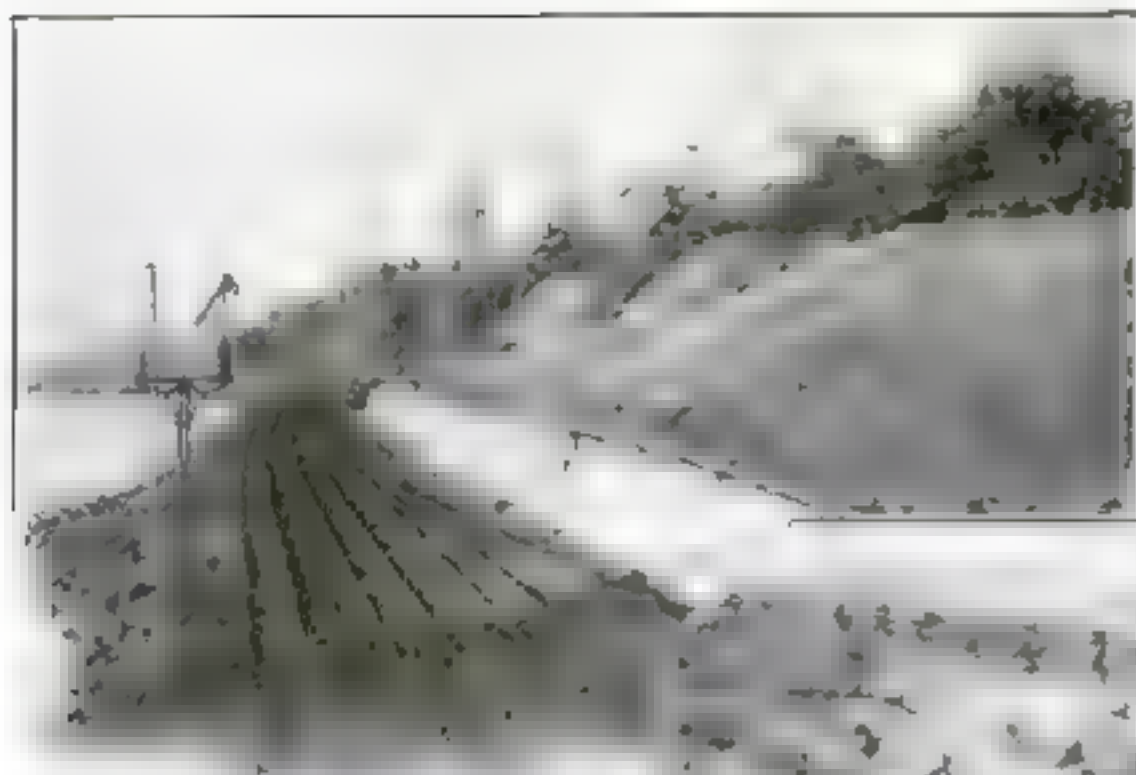


Popular new bicycle-scooter is built also with balloon tires and a parking stand









N. Y. Central tracks as they appear today

**R**IVERSIDE PARK, along the east bank of the Hudson River, one of the most attractive parks in New York City, has its beauty marred by railroad tracks, coal pockets, and garbage dumps at the water's edge.

An ingenious plan by Charles L. Craig, Jr., would transform the ugly, narrow, and noisy water-front into playgrounds, driveway, a promenade, and recreation centers, at the same time providing for the railroad, which cannot be pushed off Manhattan Island.

Land now under water, according to the plan would be reclaimed, in some cases extending the park 250 feet. A 25-foot promenade, for pedestrians only, with a sea wall, would extend the entire length of the new section. Back of this would be lawns and shade trees, with rest houses provided at convenient intervals, where people might sit and watch the passing steamers, or enjoy the view of the majestic Palisades on the opposite shore.

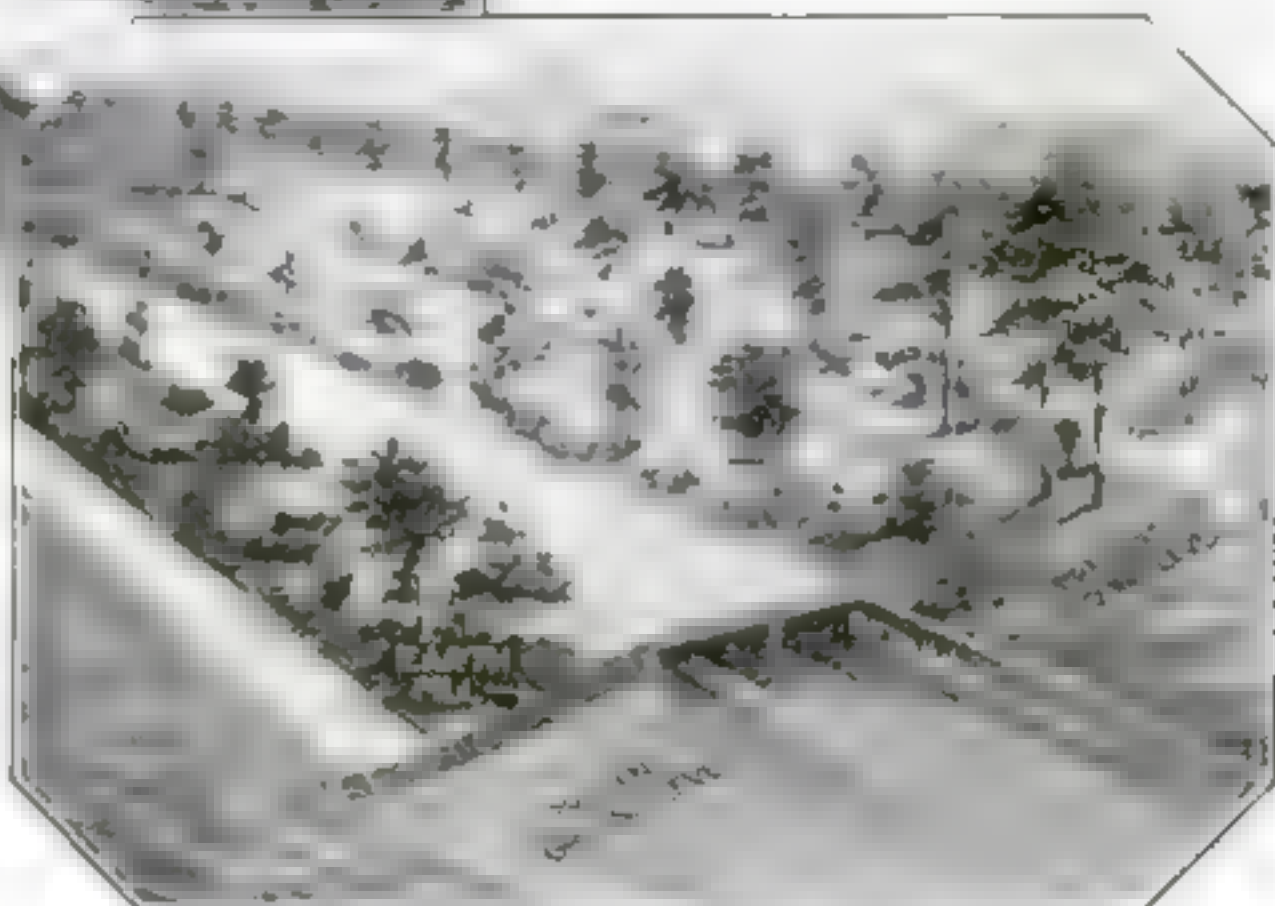


### Lump of Seaweed Said to Be Millions of Years Old

**A** 500-POUND lump of petrified seaweed discovered in the Medina sandstone of Pennsylvania, is believed to be 60 million years old. It was exhibited recently at the Department of Geology of the University of Pennsylvania by Dr. Frederick Ehrenfeld.

The structure of the sea plants can be seen very clearly in this unique rock, which is but another piece of evidence that the ocean once covered this part of our country.

## Three Miles of Railroad to Be Roofed by a Boulevard



Architect's drawing shows transformation of tracks and water-front

The railroad tracks would be roofed over by a wide boulevard for automobiles. This would relieve part of the congestion on Riverside Drive, the street now above the park, and would speed up traffic, since the three-mile stretch would be broken by

only one crossing according to the plan.

The plan provides for 22 acres for lawns and tennis-courts. A fresh-water pool three blocks long would be provided, to be used in the summer as a swimming-pool and in the winter as a skating-rink.

### Glass Dancing-Floor Is Lighted from Below

**W**HEN the moon is not shining, one still may dance under the stars at Biarritz, a popular French seaside resort. There, in the beautiful gardens of a pleasure club, a wonderful

glass floor illuminated from below gives all the light necessary for dancing.

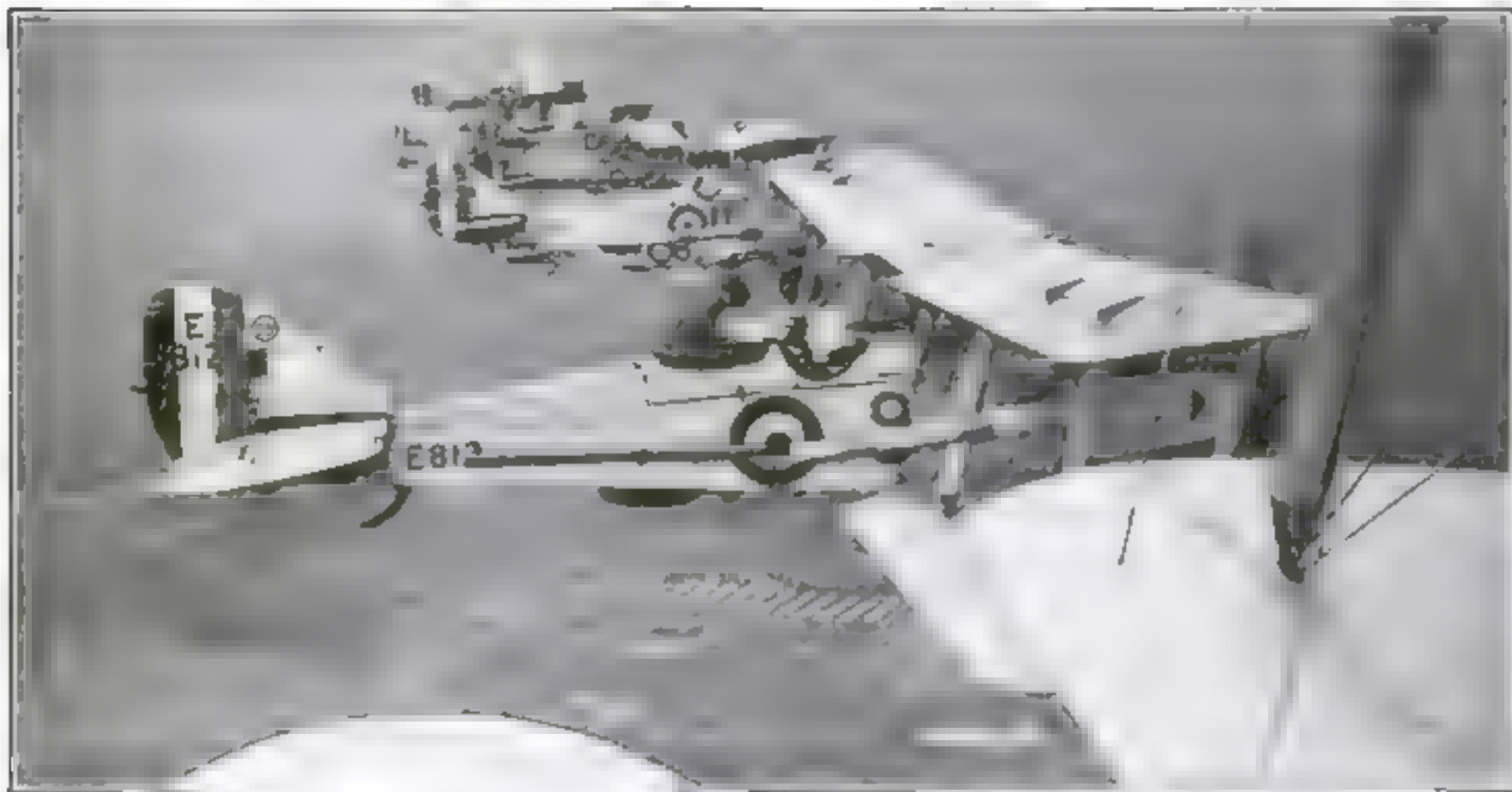
The effect is attractive and the idea could be employed as a novelty in both indoor and outdoor dancing-rooms.



A fairylike scene at Biarritz, France, where lights shine through a glass dance floor

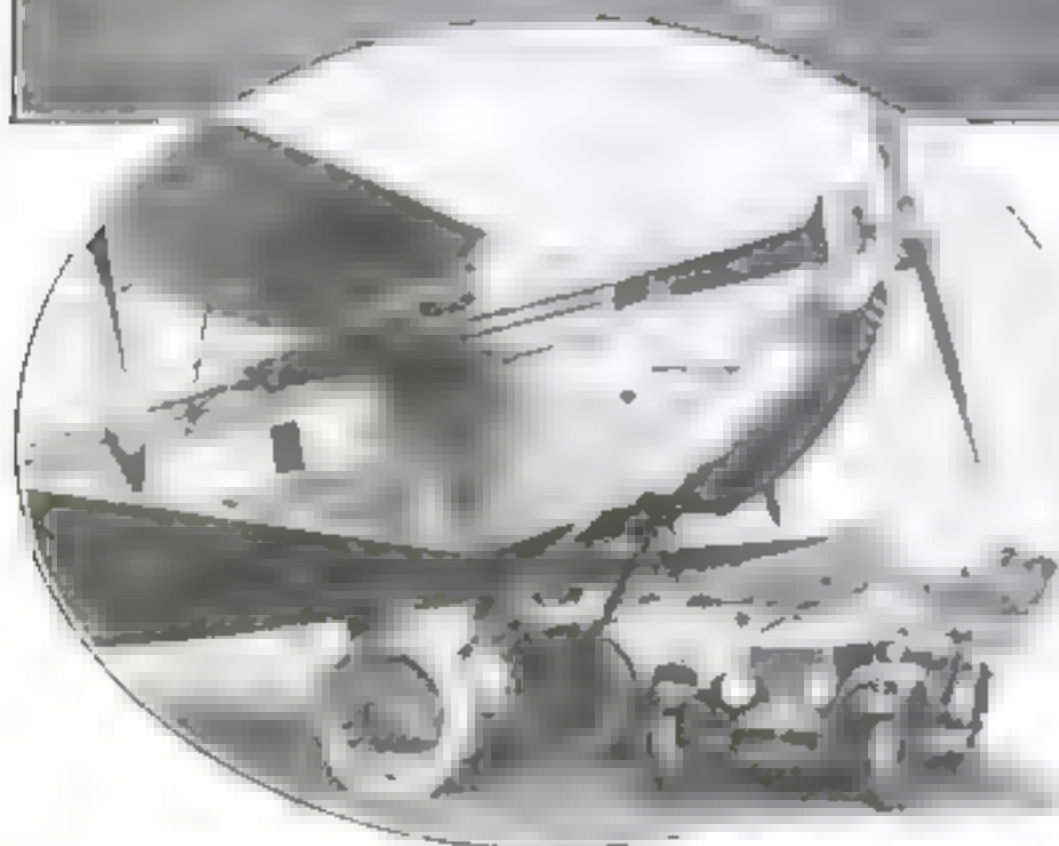


# Sky Traffic and Its Progress



British Planes Fly Wing to Wing

(The British Royal Air Force) was breath-takingly even formation



Powerful British Plane Carries 16 Passengers

The most powerful single-engine plane to date, built by the British, it carries 16 passengers, with a cruising speed of 100 miles an hour.



Jumps from a Dirigible

Parachute jumping from an airplane is not uncommon, but Lyman H. Ford recently jumped from the U. S. dirigible Shenandoah, when it had reached a height of 1500 feet, landing safely in a park.

The Smallest Airship

At Dayton, Ohio, for the first time a commercial airship was inflated with helium (left). It is 110 feet long, contains 50,000 feet of helium, the non-inflammable gas, and carries four persons.

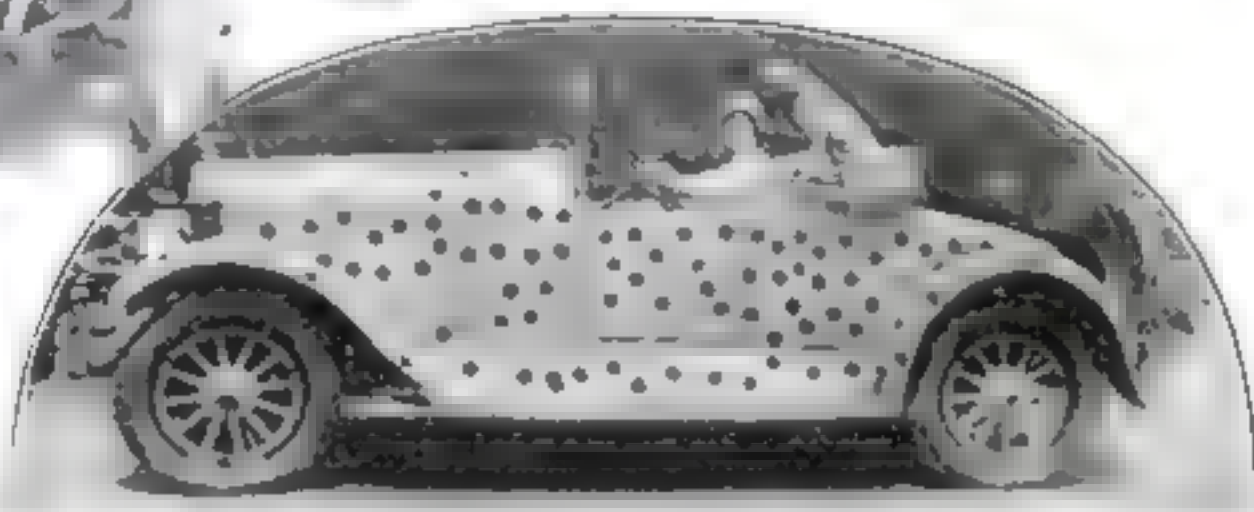


# Some Curiosities from the Motor World



## He Calls It an Automobile

This freak machine was built of airplane parts by a soldier at Mitchel Field, L. I. Driving and gear-shifting are done from the wheel. The driver's head sticks out as from an airplane cockpit when the door is shut.



A Dalmatian dog is responsible for the photograph above. Miss Louise Hunter, of Atlanta, Ga., owns the dog, and his somewhat startling decorative scheme suggested the gown and the car, with the above result.



## Racer Breaks Rear Axle

A car driven at full speed by Leon Dury in a race at Altoona, Pa., recently suddenly broke its rear axle and collapsed. This remarkable photograph shows the peculiar appearance of car after the accident.



## Quick Wit Saves Driver's Life

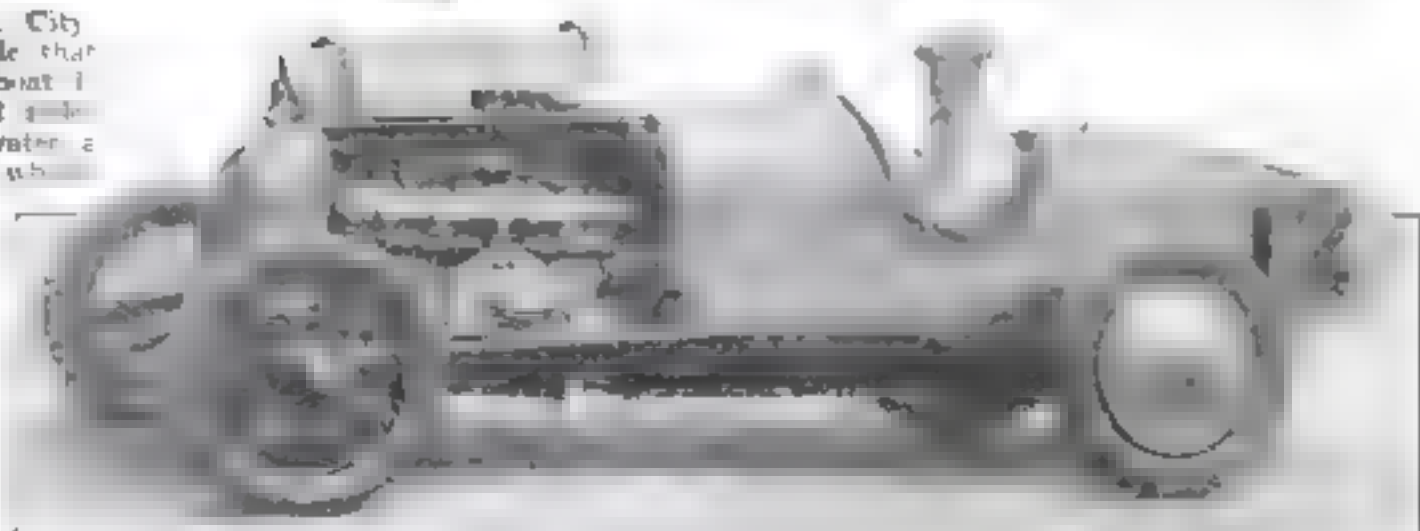
Quick thinking saved "Dick" Ryan, racing driver, from a terrible death. While driving on the track at Atlanta, Ga., his car caught fire. Ryan headed straight for the fence encircling the track, crashed through, and plunged into a lake below. He made his escape as the car hit the water, suffering only a few scratches about the face.

## A Three- Wheeled Automobile-Boat

Philip Matcovich, of Long Island City, N. Y., has invented an automobile that swims. On land the automobile-boat is said to have a 30-mile speed; 12 mph afloat. When the machine enters water, a rudder and propeller replace the rear wheel.

## A Champion Racer

Here is Peter De Paolo's winning racer fitted with the remarkable supercharger that forces air into the carburetor at high speed. Tests show that the new supercharger raised the pressure in the manifold about 11 pounds to the square inch.







### Newest Trousers Press Is a Camouflaged Chair Back

**STORING** a bulky trousers press has long been a problem to the well-dressed man and the neat housewife. This particular problem has at last been solved, however, by an English manufacturer, who has hidden a press in the back of a bedroom chair. The bottom boards of the press form the actual chair back. Two boards hinged to the chair uprights form the top sections of the press.

The trousers are inserted, the top boards folded together, and the bottom lever is closed. A pull on the projecting part of the trousers stretches them, then the top lever of the press is closed.

### Self-Feeding Shaving-Brush Carries Its Own Soap

**PRESSING** on the bottom of the handle of this unique shaving-brush injects sufficient cream into the bristles for a shave. The container, made of hard rubber and resembling an oilcan in shape, holds enough shaving-cream for two months' use.

The bristles are set in rubber and the brush is ornamented with a nickel-plated cap.

**THAT** France secretly is building a large hydroplane with which it is hoped to fly the 4000 miles between Paris and New York without stopping, is a recent report from the French capital. The plane will have a motor of 550 horsepower and carry 1584 gallons of gasoline.



Pressure fills brush with shaving soap

### Makers of Collapsible Golf Tee Claim It Improves Stroke

**UNDER** hard driving the new type of golf tee flattens out, then springs up in the same spot. This collapsible feature makes it impossible to injure a stroke, it is claimed, and the club head passes over the tee easier than it would on the gritty surface of an ordinary tee.

The tee is made of surplus cloth cemented between sheets of pyroxilin to give it resiliency and endurance.

Insects and grubs cause an annual loss of \$800,000,000 to the agricultural interests of the United States, and farmers,



No flying grit with new golf tee

fruit-growers, and gardeners pay another \$800,000,000 each year trying to get rid of these pests.

### Frenchwoman Invents Painless Slaughter Gun

**SLAUGHTERING** cattle by hitting them on the head with an ax is needlessly cruel in the opinion of Madame Simon, founder of the French League for the Protection of Animals.

To replace this method she invented, recently, a revolver of large caliber that kills without a bullet.

A powerful explosive drives a four-inch spiked tube with terrific force into the brain of the beast. There is no trigger. The operator simply presses the barrel tight against the head of the animal and the spike is fired into the brain automatically. It afterward returns into the barrel.

The new weapon has been adopted for use by a Paris slaughter-house.



Humane slaughter gun and its inventor

### Snapping Shrimps Make Their Homes in Sponges

**SPONGES** are the beehives of the sea. This curious discovery was reported to the U. S. Bureau of Fisheries by Dr. Charles J. Fish of the scientific staff of the New York Zoological Society's steamer *Arcturion*, cruising in tropical waters. The "bees" that Doctor Fish found inhabiting the canals of the sponges were whole colonies of the snapping shrimp *Alpheus*. These society-loving shrimps, he discovered, swim about freely, but always return to the particular sponge that is their home.

### Typist's Posture Improved by Novel Outfit

**UNLESS** she keeps it always in mind, a typist is apt to become round shouldered from sitting in a slouched position before her typewriter. While chairs made scientifically to fit the hollow of the back cause her to sit erect, still, she usually has to bend over to read her notes.

A new equipment fastened to the typist's desk helps her to sit erect at work without discomfort. A rest is provided for the feet, tilting the body back properly, while a notebook holder is supported above the typewriter at a good angle for reading.

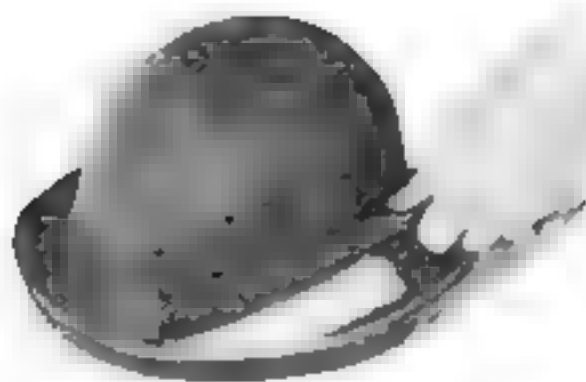
### Serums to Protect Stock

**SERUM** to inoculate stock against diseases, some of which never have made their appearance in this country, is kept in storage at Washington by the U. S. Department of Agriculture.



Typist's chair and table assure correct posture





Combination brush has convenient shape

### Clothes and Hat Brush in One Is Handy for Traveling

**H**AT brush and clothes brush are combined in one handle in this new traveling accessory. The white brush is softer than the black one and made especially for brushing hats.

If the Pullman porter forgets the final touches before you leave the train, you yourself can get rid of the train dust with this brush that slips easily into your traveling-bag.

A TALKING wire that can be used by American business men to dictate letters or instructions across the Atlantic, or by means of which European radio fans can record entire programs broadcast in the

United States, is the result of 18 years of laboratory research by Dr. Kurt Stille, a German scientist. The apparatus resembles a desk telephone and is equipped with both transmitter and receiver.

### Watch-Chain Safety Catch Foils Pickpocket

**A** UNIQUE watch-chain fastener, invented recently by George Stiegler of Cincinnati, Ohio, slides on the belt. The cross bar of a watch-chain slips under a raised part of the fastener, and lies next to the belt.

The same chain used when the watch is worn in the vest, thus can be used when the watch is carried in a trousers' pocket. The fastener is adaptable for all styles of chains.

### New "Invisible Light" Renders Opaque Objects Transparent

**BY** MEANS of "invisible light" that he recently perfected, Sir Jagadis Chandra Bose, a distinguished scientist of India, in a recent demonstration before a group of scientists, proved that a heavy book can be made transparent. The light, called "super-retina," consists of short electric waves having the same properties as a beam of light. These waves are absorbed selectively by different substances. Coal-tar pitch is among the objects that it renders transparent, while water, on the other hand, is made opaque. Sir Jagadis claims that plants can perceive these invisible beams, though human beings cannot. He perfected his instrument after 30 years.



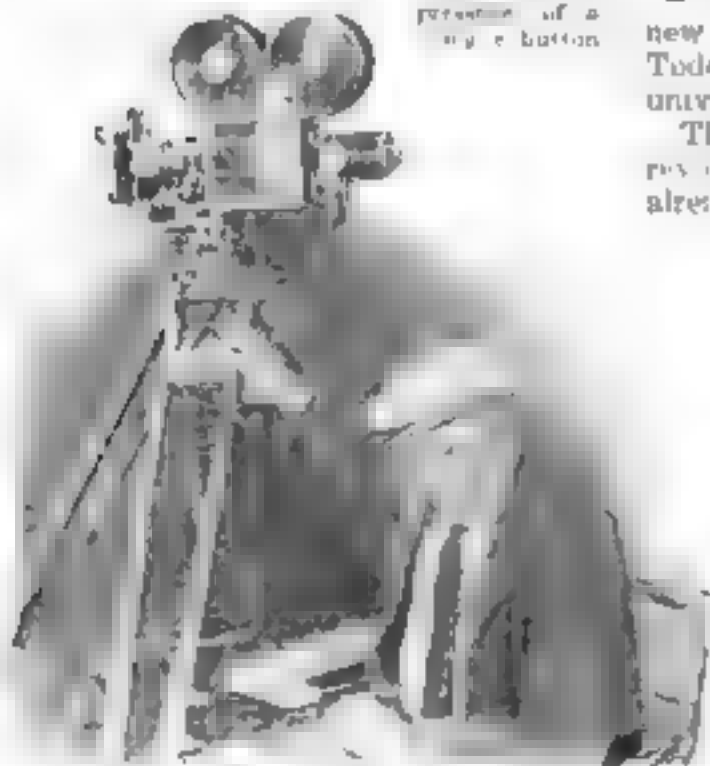
Simple catch secures watch-chain

### Surgeon Signs Operation

**A** NEW practice has started among surgeons of signing operations. Dr. Evan O'Neil Kane, of Kane, Pa., marked a patient's skin with a small amount of India ink in radio code alphabet. Doctor Kane believes that a code could be arranged among surgeons for use in emergency operations, when a patient is unable to tell of previous operations that he has undergone.

### Device Eliminates Movie-Camera Grinding

Movie camera is operated by pressing of a single button



**G**RINDING movie cameras by hand will be a thing of the past when the new motor control, invented by Arthur Todd, motion-picture cameraman, is universally adopted.

The new device, which is expected to revolutionize the art of cinematography, already is being used in the studios of Hollywood. Instead of the old hand-organ technic, all the cameraman has to do now is press a button that controls the motor, and the film travels.

The photograph at the left shows the cameraman in the act of starting the machine by the new method of simply pressing a button.

With a three-hour handicap a homing pigeon recently won a race against an airplane, flying between Paris and Brussels, 170 miles, in four hours.



### Hang Moth Balls in Clothes by Means of New Spiral Holder

**M**OTH balls in a handy spiral container shaped like a spring can be hung inside a coat on a clothes-hanger, or hung on the door-jamb or hooks in a closet to make the whole closet moth-proof. This is also a good way of placing the balls in blankets or clothes stored in boxes or trunks, as it simplifies their removal when the articles are needed for use in a hurry.

LATEST reports from the U. S. Patent Office, through Patent Commissioner Robertson, show that applications for patents are granted now in about two, or not longer than five, months. Commissioner Robertson reports that in 1923 there were 72,476 applications pending. A year later the number was 59,000, and at the end of the fiscal year of 1925 only 43,000.

### Toothbrush Holder Acts as a Constant Sterilizer



Sterilizing tube for toothbrush

**W**HEN toothbrushes get too dry, they become harsh and stiff and the bristles irritate the gums. A new tube for the brush keeps it at the right temperature, preventing this.

On the bottom of the tube is a cotton pad saturated with a medicated solution that sterilizes the brush between each using.

### How Uncle Sam Killed Gophers

**G**OPHERS burrowing in the army landing-fields of the U. S. Naval Air Station at San Diego, Calif., so undermined them that they were causing serious accidents to landing planes. An appeal was made to the U. S. Department of Agriculture, which prescribed that poison be poured in the gopher holes and the mounds leveled with a steam-roller. This practically cleared the landing-field of rodents.



## Compact Outfit for Replating Silver at Home



Negative and positive wires are adjusted and the plating pad does the work.

**T**HERE is a compact home outfit for replating silver by which the metal is rubbed on with a pad.

The negative terminal is fastened to the article to be plated. The positive wire leads to the plating pad, a fabric container holding a dry composition of acids and finely powdered silver or other pure metal.

After being soaked in water, the pad is passed slowly over the surface to be plated. When the moist pad touches the article, the circuit is completed and the metal deposited.

The wiping action is said to have a burnishing effect so that no oxidation occurs. Thus it is possible to electroplate iron without a copper coating.

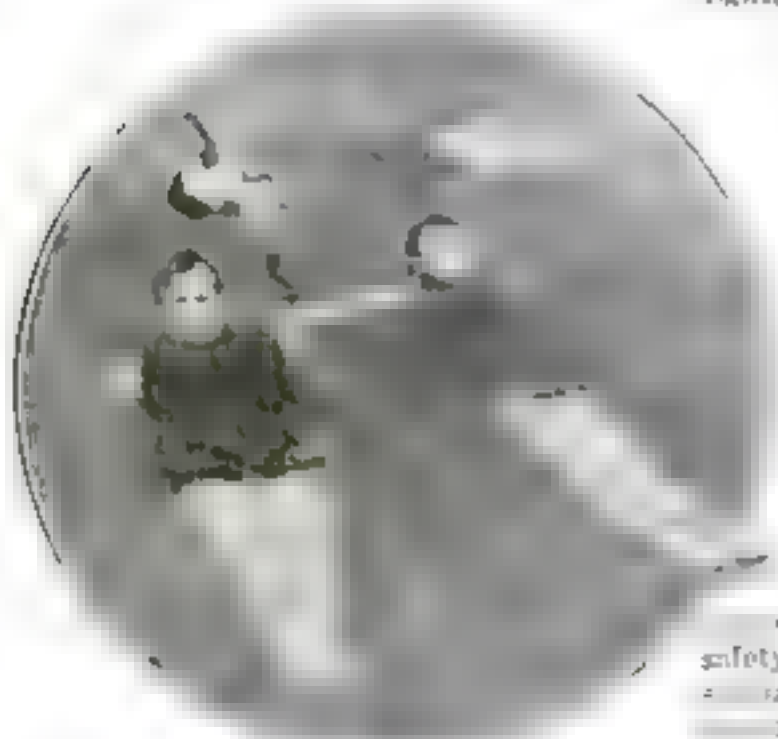
## Playful Porpoises Sacrificed to Needs of Watchmakers

**O**BSERVING schools of porpoises sporting about in the water, few ocean travelers are aware that these strange animals have supplied them with an important product. The watches ticking in their pockets probably are lubricated with porpoise oil.

Oil for timepieces must answer very exacting requirements, among them, insensitiveness to heat and cold. At night watches are exposed to chill air after having been carried close to the body all day. The oil must not thicken or congeal on account of this change of temperature.

That extracted from the jaw pans of porpoises is said to be unsurpassed for lubricating watches. With the large increase in watch factories in the United States, porpoise-fishing has become an important industry all along the Atlantic coastline.

## No Inflation in These New, Unsinkable Bathing-Suits



**Y**OU may be a perfect dufer in the water, not know how to swim a stroke, and yet go with safety beyond the six-foot line. That is, if you have on a non-sinkable bathing-suit, designed for the person who cannot learn to swim, and that keeps him afloat and gives him confidence.

These new suits, said to have been

## Houses Built of Steel, Cork, and Concrete

**H**OUSES made of cork on steel frames are the latest type of structure built in England, where great efforts are being made to plan houses that can be built rapidly by unskilled labor.

Slabs of compressed cork two inches in thickness are placed on a steel framework and this is inclosed in concrete, which is applied with a cement gun. The cork insulates against dampness, heat, and cold, serving the same purpose as air spaces in concrete or brick houses.



Concrete is sprayed on cork-covered steel-frame houses.

tried out successfully at beaches near Washington, D. C., recently, are made in one piece, fastening down the front. They are not inflated, but are made of light, non-sinkable material.

**W**HEN your fountain pen runs dry and you have no ink, usually you can obtain a supply of writing fluid by filling the tube half full with water. As a rule, there are enough ink crystals in the tube to make a fairly good writing fluid.

## Pocket Camera Has 100-Film Roll

**O**NE hundred snapshots can be made with this minute "vest-pocket" camera with a single loading. It is not much

larger than a box of Swedish safety matches and takes a small roll of film, much like a 16-mm. picture film, without the side perforations.

It will take views either from the horizontal position or from the vertical. The exposure speeds range from one second to 1/3000 second. By a special system of ratchets on the film spool, the film unrolls for only one view at a time when the pictures are being taken.



— pocket camera that holds 100-film roll contrasted with a matchbox to give an approximate idea of size.

## Malaria Inoculations Cure N. Y. Paresis Victims

**T**HIRTY patients in a New York hospital, once believed hopelessly insane, are back at work, leading normal lives, cured by having been infected with malaria germs. The astounding method of curing a mental disease by inflicting the patient with another disease is meeting with marked success, according to reports issued recently from the Long Island College Hospital.

The malaria method of treating paresis, always considered an incurable disease, was originated in Austria. Malaria germs are injected into the veins of the insane person. After from seven to 14 days, when fever develops, it is broken with quinine and, following this, salvarsan is administered. Just how the malaria works to combat paresis is a mystery.



## Device Controls Sound Waves to Master Record

**I**NSTEAD of having the artist speak, sing, or play directly into the horn, this new invention uses electricity to convey the sound waves to the wax record on which they are recorded for the making of phonograph records.

The desired tone can be obtained by the use of this device as the sound is regulated by electrical control. Orlando R. Marsh, of Chicago, is the inventor. He is shown in the picture recording an organ number.

A NEW motor alcohol made from molasses and the juice of the sugar palm is said to make starting easy and eliminate knocking and carbon troubles. Its disadvantage is the cost of making it, but extensive experiments are being made in Hawaii to overcome this.



Sound waves enter horn at whatever strength is desired by operator of new control

## Japan Guarding against Future Earthquakes



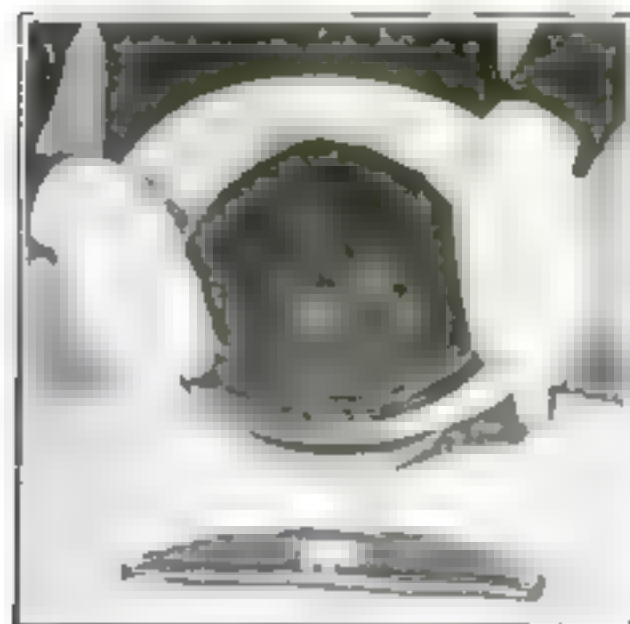
A corner of Tokyo's recently organized Bureau of Standards

**I**N REBUILDING their great city of Tokio, destroyed by earthquake, the Japanese are taking the utmost care to get nothing but good materials. A testing bureau has been established, somewhat like our government Bureau of Standards. The new buildings in Japan's capital will be far different from those of wood and paper that fluttered to the ground in the last great disaster, it is certain.

## Hats Are Made to Fit with a Self-Adjusting Silk Pad

**E**XACTLY how many hats have been thrown away on account of bobbed heads has not been estimated, but they number in tens of thousands. Old hats will not fit with the wearer's hair cut off.

To make large head sizes smaller to fit smaller heads, a new hat size-reducer has been put on the market. It is a narrow silk-covered pad, which is pressed into place with three small prongs, requiring no sewing or adjusting.



How the hatband is adjusted to reduce head size and the band itself

To ease the diseased lung of a tuberculosis patient, a British inventor has produced a machine which pumps air into the thoracic cavity by way of a hollow needle inserted between the patient's ribs.

## Births Now Exceeding Deaths in the United States

**A**LTHOUGH the population of the United States is now at the high-water mark of 114,311,000 people, the advance over last year was less than the average for the last five years, according to recent estimates of the National Bureau of Economic Research. The once rapid advance, it is believed, has now definitely slowed up.

That the regular increase in the population has not been due to immigration, but to the excess of births over deaths, is shown by figures covering the last 16 years. In that period there were more than 41 million births and about 22 million deaths, or an excess of 19 million births. About 5 1/4 million were added by immigration, bringing the total increase to about 24 million. Of this number, immigrants formed little more than a fifth.

Ten years ago the birth rate was 26.2 for each thousand persons, while today it is 23.3. At the same time the death rate has decreased from 13.4 to 11.7.

## Alabama to Have World's Largest Artificial Lake

**W**HAT will be the largest artificial lake in the world, is being built in a remote section of Alabama to assure a constant flow of water for driving three large electric generators. These will feed power into the electrical transmission system of the state.

With the exception of those at Niagara Falls, the three 45,000-horsepower water-wheel-driven generators will be the largest in the United States. The artificial lake will have a shore line 700 miles long and will cover 40,000 acres of farm and forest land. Agricultural experts believe that the construction of the huge lake will make a vast section of the country to the south of the lake frostproof and advantageous for fruit-growing.

## Man Sails 202 Miles Down the Mississippi on a Mattress



**I**F YOU want to take an inexpensive trip, think over the possibilities in your own home in the way of water craft. You might make a raft of the dining-room table, or, there are the mattresses.

Sidney Helms, of Des Moines, Ia., had an idea that he could negotiate the 202 miles of Mississippi River between his home and St. Louis on an ordinary mattress. Friends laughed at him, but he tacked the mattress to a light frame and added an outboard motor.

The photograph above shows Mr. Helms' arrival at St. Louis.



# Modern Utensils *for*

*On These Pages the Expert Housewife  
the Labor of Every-Day Tasks and*



## Five Tools in One

For window-box gardening a new set of five gardening tools, used with a single handle, is a decided convenience. The set may be stored away in very little space and yet every sort of tool likely to be needed in such work is available.

## A Knife-Sharpener

A tool for sharpening any shape blade is screwed to table or wall. Twin grinding wheels of fine corundum are held together by a pressure spring. When being sharpened, the knife blade rests in a beveled groove.



## Duster Glove with Cuff

A duster in the shape of a large glove is made to fit either hand and has a long cuff that protects waist or shirt. Grease does not penetrate the glove so that a person with a cut or bruised hand is protected from possible infection while using the duster.

## Three-in-One Kitchen Tool

Orange juice may be prepared in a jiffy with this little combination household machine. Besides extracting juice, it will beat eggs and sharpen kitchen and table knives.



## New Washing Machine

Specially built for apartment use, this new washing machine stands on one leg and is held by two rubber-covered hooks to the edge of the sink, laundry tub, or bathtub. It is run by water power. Washing, rinsing, bluing, and drying all are done without removing the clothes from the machine.

## Electric Doughnut Frier

Doughnuts can be fried by electricity by putting this electric plate inside your doughnut kettle. The heated grease circulates through the holes of the plate, which is so wired that an even temperature is maintained. The plates are made in several sizes to fit standard kettles.

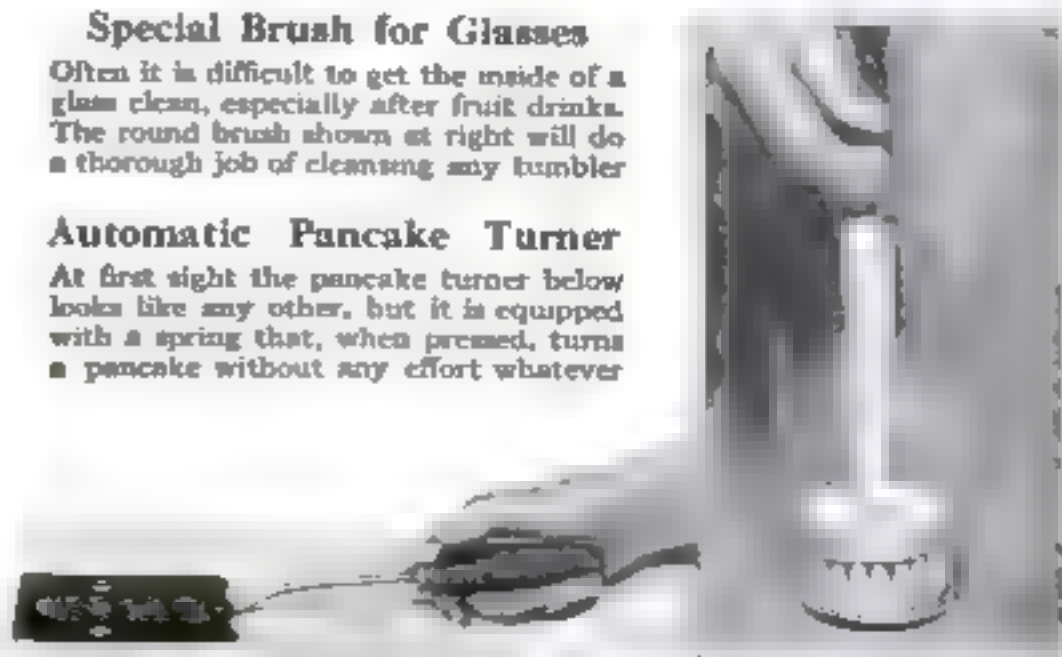


## Special Brush for Glasses

Often it is difficult to get the inside of a glass clean, especially after fruit drinks. The round brush shown at right will do a thorough job of cleansing any tumbler.

## Automatic Pancake Turner

At first sight the pancake turner below looks like any other, but it is equipped with a spring that, when pressed, turns a pancake without any effort whatever.





# the Up-to-Date Home

*Will Find Valuable Suggestions for Easing  
Reducing Their Drudgery to a Minimum*



## Single-Burner Top Oven

The useful and economical oven shown above bakes over a single burner on a gas, oil, or electric stove. For kitchenettes or camps, where space and heat must be considered, it will be found especially useful.

## Mop and Wringer

A simple twisting motion forces water to the surface of the mop and a metal squeegee rubs it off. The mop has no wooden roller to get out of order and will wring out any soft material.



## Small Vacuum Cleaner

This little hand electric vacuum cleaner is a complete machine in itself and with the auxiliary dustbag weighs less than three pounds. It may be attached to a light plug.



## Kettle Lights Gas-Ring

A gas-burner that lights when a kettle is put over it and goes out automatically when the kettle is removed is a new economy device for the kitchen. When the kettle is off, a small pilot light remains burning.

## Reminder Clock for Cooks

When it is time to take the cake out of the oven, an alarm-clock goes off. A little knob in the lower right hand corner sets the dial for time desired.



## Bottle Cover and Opener

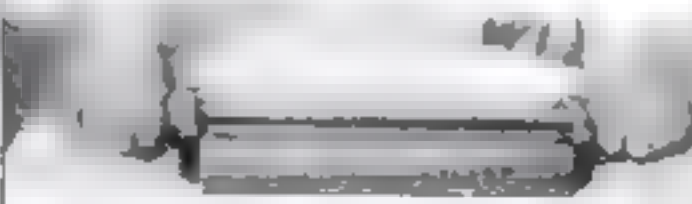
The combination milk-bottle cover and opener shown at the left is made of metal. The pointed projection on the cover removes cap easily.

## Sealer Straightens Caps

A new fruit-jar sealer fits over the top of a screw cap. Damaged caps can be used, since the sealer straightens out the edge and prevents leaks.

## A Double Rolling-Pin

In this double rolling-pin, one roller, directly back of the other, smooths out any bumps in piecrust or noodles left by the first roller as it passes over them.



## Vegetable Cooker and Drainer

Vegetables are cooked in a wire basket that rests in a new type of cooking-pot. After the water has been drained off, the basket is whirled by turning a handle on the pot cover. This leaves the vegetables dry.





Milwaukee man carves oak replica of da Vinci's famous picture

## A Picture Copied in Wood

FROM a slab of solid oak, August Eberhart, of Milwaukee, Wis., recently completed a remarkable copy of da Vinci's "The Last Supper."

Great delicacy and fineness of detail in the work make it distinctive. Mr. Eberhart achieved an almost cameo effect although working with a slab of the hard wood 40 inches long and seven inches thick.

Mr. Eberhart, shown in the photograph with his work, learned wood-carving when he was only 14 years old.

A CARILLON of bells in Bruges, Belgium, is famed throughout the world, so it is no mean commendation when a carillon for America is likened to it. The latter chimes consist of 58 bells, to be erected in the Park Avenue Baptist Church of New York City, the gift of John D. Rockefeller. The carillonneur of Antwerp Cathedral has been engaged permanently to play them in New York.

## Ingenious New Sun Clock Comes from Australia

A NEW kind of sun-dial that tells time within 30 seconds of an ordinary clock, has been invented by an astronomer in Australia. It consists of a ring that can move on pivots placed in a north and south plane.

On one side of the ring is a small hole, which, when the sun is shining, casts a small spot of light on a figure 8 on the opposite side. This curve is marked with the date for various times of the year and allows for the amount that the sun is ahead or behind its average position.

The ring is turned until the spot of light is on the proper part of the curve and the hands, which are geared to it, then indicate the correct time.



## Warning Traffic Signal Is Built like Speedometer

A UNIQUE warning signal made to resemble an automobile speedometer warns motorists in St. Louis of the seriousness of careless driving. At the top, where the mileage figures usually go, is the number of deaths from motor accidents that occurred the day before.

Beneath that, in the place where mileage usually is recorded, are the number of total deaths for the past week and total deaths for the year. A sign below gives the total of motor deaths during the same period a year before. Signs radiating from the "speedometer" give bits of advice.

THERE is little, if any, difference in the tastes of negroes and white persons so far as colors are concerned, as determined in tests made recently by Miss Florence Mercer of Texas Women's College. Examining more than 1000 negroes in Texas public schools, she found that children in the first and second grades preferred red, with blue, green, and violet following in order. This preference changed through the grades until the eighth-grade pupils named blue as their favorite color with red liked least of all. White school children tested showed the same results.

## Sisters Talk to Each Other across 150 Miles of Sea

A WOMAN on an Atlantic liner called up her sister on another ship 150 miles away, recently, and the two carried on a conversation lasting eight minutes. This was the first trial of a new marvel—a wireless telephone invented in Germany that can be used either between two ships or between a ship and land.

Previously, messages could be spoken only one way over wireless telephones. Only when the speaker had finished and the receiving antennas had been switched on, could a person at the other end reply. Now messages may be spoken both ways simultaneously and interchangeably.

## Home Fire-Gong Gives Alarm at 120 Degrees of Heat

THIS little mechanical device requires no attention, and has no electrical connections. It is a fire alarm for the home. When the temperature in its vicinity is raised to 120 degrees, a fuse melts and releases the small gong, which rings for some time.



Showing how that winds fire alarm

## Pliers with Three Grips

IT IS said that these novel pliers can exert more gripping force on odd shaped surfaces than is obtainable with any other type of hand tool. A combination of geared and cam leverage is responsible for this strength. The pliers has a special pipe jaw and a round-nosed jaw that can be substituted instantly for the standard jaw for certain kinds of work.



Pliers grip out with unusual strength

## Know Your Car

THE linings of most automobile brakes wear out long before they should, simply because they are used too much. Traffic emergencies arise, of course, where a sudden and strong application of the brakes is absolutely necessary. In ordinary driving, however, the use of the brakes should be avoided whenever possible. Instead of keeping your foot on the throttle until the last minute, then jamming the brakes, shut off the power in advance, so that the car will slow down gradually with just a touch of the brake.

Brakes will last much longer if five simple rules are followed:

- 1—Coast to a stop instead of jamming on the brakes.
- 2—Throw car into second speed at the top of long, steep hills, and let the drag of the engine serve to retard the speed of the car instead of the brakes.
- 3—Keep mud and grit out of the brake linings.
- 4—Wash the brake linings with gasoline if oil leaks out on them.
- 5—When you renew the brake linings, be sure to polish the brake drums with fine emery paper if they become roughened.



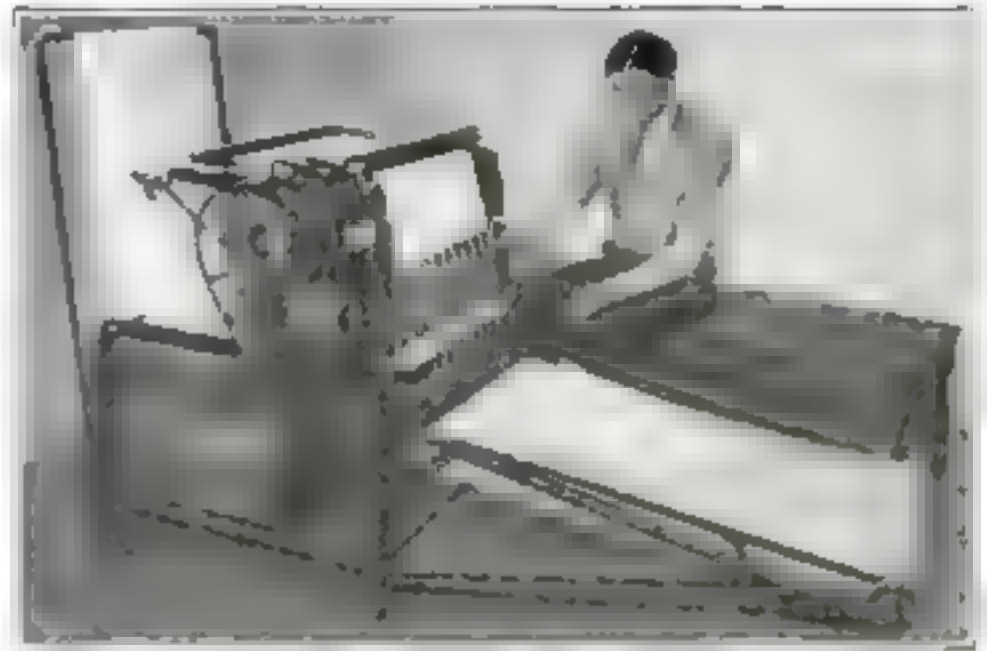
## Ingenious Handkerchief-Cutter

**A**N AUTOMATIC handkerchief-cutter, taking up only 15 square feet of floor space, less than a tenth needed for the ordinary machine used for this purpose, is the invention of Max Schleifer of Newark, N. J. For half a century the handkerchief industry has been seeking to perfect a small practical machine of this type.

The new machine will measure, cut, assemble, and count 200 dozen handkerchiefs an hour, 50 dozen more than the machines now in use. It stops automatically if the supply of material runs out or defects occur in the material. This automatic action enables one boy to operate three machines.

Any size handkerchief from six to 20 inches square may be cut. The machine rollers adjust the material so that the machine is said to cut straighter lines than a man can, using a knife.

RECENT researches with fowls have shown that the quantity of grit carried ordinarily in the gizzard of a chicken is sufficient for a year's use, supposing the chicken could get no more.



Machines measure, cut, assemble, and count handkerchiefs

## American Establishes Figures for Earth's Diameters

**A**N AMERICAN scientist has determined the earth's diameters so accurately that his figures have been adopted by all countries. Director John F. Hayford, head of Northwestern University College of Engineering at Chicago, is responsible for this triumph.

The diameter is 7,926,678 miles at the equator, while the diameter from pole to pole is 7,899,964 miles, proving the earth to be a sphere flattened at the poles. Director Hayford's figures will be the basis of every boundary survey in the world in the future.

The ingenious roller for turf tennis-courts, driven by pedals, like a bicycle, is so geared that a woman can manipulate it easily.



## How the English Roll Their Lawns and Tennis-Courts

**W**HEN a turf tennis-court needs rolling, every fellow tries to shift the job to another. It's no fun, but real work, pushing a roller. A machine has been invented recently in England, that may induce even the girls to take a turn at rolling.

It is a combination bicycle-roller operated by pedaling. It is so geared that the effort ordinarily spent in running a bicycle pushes the machine about the court or lawn.

## High-Pressure, Hot-Air Fan Dries Hay in Eight Hours

**A** FEW months ago POPULAR SCIENCE MONTHLY described a method that English farmers were using to dry hay artificially in the fields. Now the University of Wisconsin, on its experimental farm, is demonstrating a similar hot-air drying process.

By means of a high-pressure hot-air fan, new-mown hay was ready for baling eight hours after raking. Ordinarily, it would have taken two or three weeks of field drying, and the owner would have had to run the risk of moisture, damage, and pests. Twelve loads can be handled on the drying rack at one time.

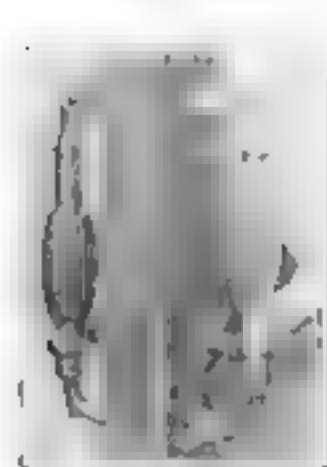
## Simple Distress Signal Code for Hunters and Explorers

**A** SPORTSMAN and big-game hunter, J. Allen Barrett, of Lykens, Pa., has copyrighted a unique idea for a national code of distress signals for persons who may be lost, injured, or in need of assistance while traveling or hunting in sparsely settled regions.

Revolver shots should be used for the signals, but the victim could shout, call, or whistle them. The chief requisite would be to have the code widely understood. The code is as follows:

To signify "lost," two shots quick, wait; one shot. "Injured," three shots quick, wait, one shot. "Sick," four shots quick, wait, one shot. "Help," two shots quick, wait, two shots. Rescuers answer, using the same number of shots, but in reverse order. The answer to "lost," for example, is one shot; wait; two shots quick.

## New Safety Door Lock Is Made without Use of Springs



Ordinary key lifts the safety bolt

**A** NEW springless device keeps a door locked automatically. The door can be opened from the inside by lifting a barrel-shaped piece that slides on the handle. This is loaded, keeping the bolt shot. A simple key locks the bolt.

## Improved Clawhammer Ax Has Many Uses

**F**OR the farm, camp, or store a handy new tool is a clawhammer ax. The claw is for pulling nails or for prying open boxes or crates.

The ax head may be used as a hammer or for pulling staples. The ax is forged solid and a wooden grip riveted securely to it so there is no danger of the head's flying off. The tool weighs only 28 ounces.



How the handle is riveted to the ax

## How Much Do YOU Know about Science?

**T**HE following questions are the kind that POPULAR SCIENCE MONTHLY receives daily. Look them over and see how many of them you can answer. Now turn to page 171 and see what percentage of the 12 questions you were able to answer correctly.

1. What colors the eyes?
2. Why does hot iron glow?
3. Why do we sometimes see a double image reflected in a window?
4. What causes quicksand?
5. Why must you use direct current in charging a storage battery?
6. Does the sun actually draw up water?
7. Why does space outside the earth remain cold, although the sun is shining through?
8. What are comets?
9. If the earth hit a comet, would there be any damage?
10. Why is it that a hurt received while you are excited is seldom felt until afterward?
11. What produced the Grand Canyon?
12. Why does a driftwood fire burn with such varied colors?



# What Set Shall I Build?

*A Vital Problem of the Radio Fan  
Who Constructs His Own Solved  
by Receivers Designed for  
Every Need*

By  
Alfred  
P.  
Lane

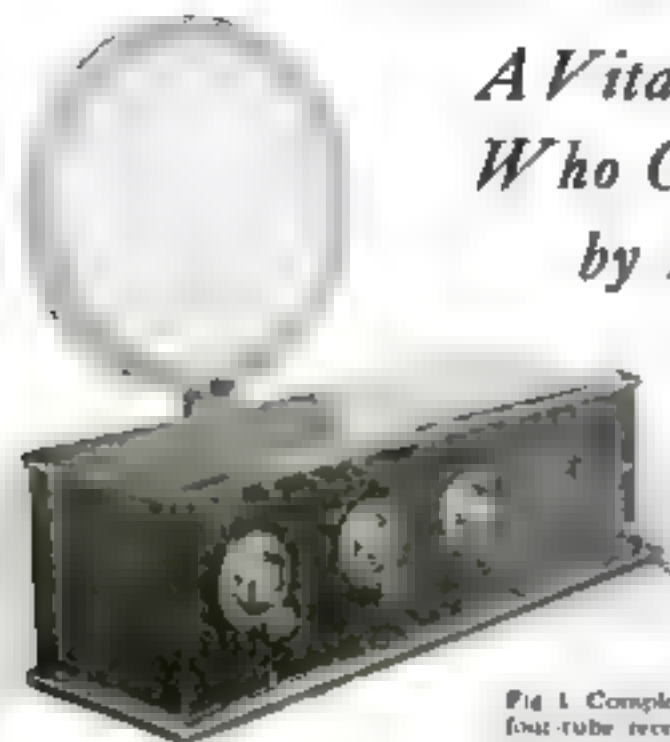


Fig. 1. Complete POPULAR SCIENCE MONTHLY four-tube receiver—ideal for the fan who has had some experience in radio construction



Fig. 2. One-tube receiver and three-stage amplifier combined in one set—a highly efficient receiver for the beginner to tackle

**T**HIS is the time of year when thousands of men and boys are turning from outdoor sports to consider the problem of what radio set to build. Large numbers of these already are radio fans. They have, perhaps, built several different radio receivers, and now they wish to rebuild their old sets or make up entirely new outfits in order to improve the distance or quality of their radio reception.

There are, also, many men to whom radio is still new and strange as far as the actual construction of a radio outfit is concerned.

On the surface the problem of what set to build seems simple enough, but unfortunately there are a number of factors to be taken into consideration which have an important bearing on whether the finished radio receiver, as constructed, will give the builder the type of service he expects.

Take, for instance, two typical cases. One is a man who lives in a large city, where there are several broadcasting stations. He wants good loudspeaker reception of local stations and cares little about distance. The other is a man who lives out in the country, where the nearest broadcasting station may be 100 miles or more away. This man must have a set capable of getting distant stations.

**A** RECEIVER that will give perfect satisfaction to one of these men may conceivably, be of no use to the other. And there are still other considerations if success is to be assured.

Ask yourself these questions: Is reception particularly good or bad in my vicinity? Is a long, high outdoor antenna possible, or must I depend on a short indoor one? Have I sufficient me-

chanical ability to build successfully a radio set? How much money can I afford to spend? Shall I be satisfied with head phones or must I have loudspeaker results?

Your answers to these questions have a vital bearing on your decision as to what radio set to build.

POPULAR SCIENCE MONTHLY has published, during the past six months, a number of designs for radio receivers that are particularly suitable for home construction. In each case a model receiver was constructed and tested by the Popular Science Institute of Standards before the article was written. Constructional details and the operation of each set were given, with a conservative estimate of the receptive qualities of the particular model being described.

Three of these radio outfits were considered to be of sufficiently universal appeal to warrant the publication of special blueprints giving details of their construction. And, although the articles

were published during the spring and summer months, when radio construction is at a low ebb, so many letters were received from interested readers that we have decided to discuss these sets again, so that if you now are contemplating the construction of a radio receiver, you will be able to decide which set is best adapted to your individual needs.

**T**HE one-tube radio receiver illustrated in Fig. 5 on the opposite page (described completely in POPULAR SCIENCE MONTHLY for May, 1925, and shown in detail in Blueprint No. 41) is a simple, easy-to-build receiver possessing many advantages.

There are no moving coils and, consequently, the tuning unit can be wound in just a few minutes. Any standard type of tube may be used with excellent results. The reception is particularly free from distortion because no audio-frequency current is allowed to flow through the tickler coil and consequently regeneration can be forced almost to the point of oscillation without any perceptible change in the tone quality.

Because of the simplicity of construction, this receiver is ideal for the man who is about to build his first radio set. At the same time it is so efficient and gives such good results in the reception of distant stations on the head phones, that it is ideal also for the man who does not wish to go to the expense of more than one tube.

Here is what one of our readers in Providence, R. I., writes us about this set:

"I have constructed the long-distance radio set that was described in the May number of POPULAR SCIENCE MONTHLY and feel highly gratified with results. It may interest you to know the stations I

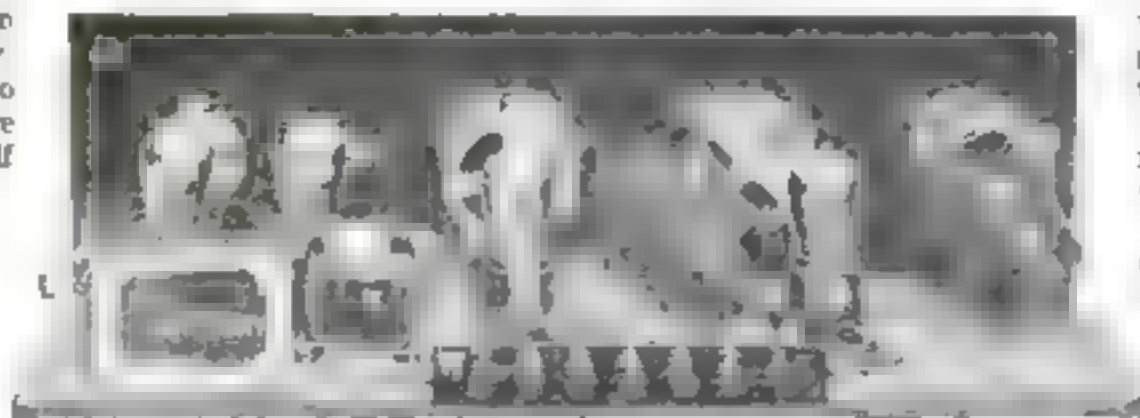
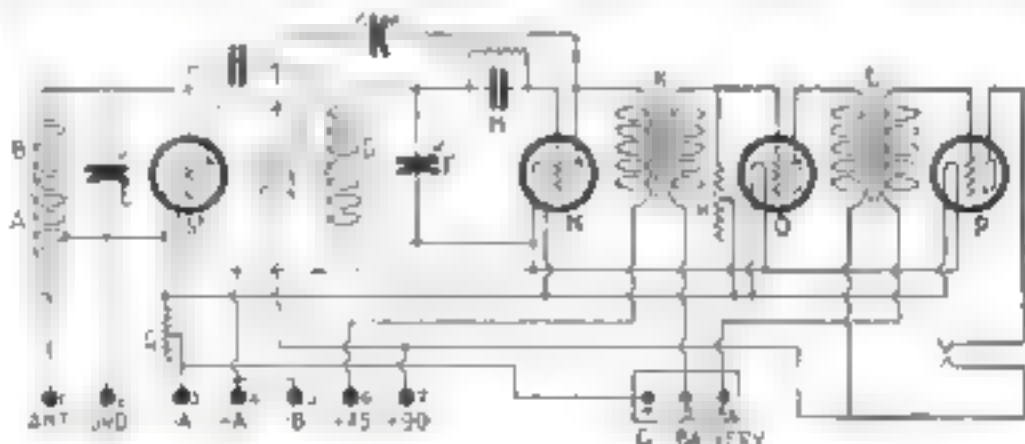


Fig. 3. Rear view of the four-tube receiver described in detail in our July issue, showing layout of parts and wiring. The complete wiring diagram appears above. This set gives maximum long-distance reception with fine selectivity



logged the first few nights that I used the set were: WEAF, WEEI, WQJ, CNRO, WLW, WLIT, WTAM, WGY, WBZ, WSAI, WGBS, WAHG, KDKA, and several others."

And this is what another reader in Jersey City, N. J., writes about the one-tube set.

"The most pleasant feature of this circuit is that there seemed to be none of the terrific squealing or re-radiation generally found on the usual regenerative set. I might say that I have experimented with different types of regenerative outfits, but I heartily endorse this one to beat them all."

Another fan in Toronto, Canada, writes:

"I have completed your one-tube receiver as described in the May issue and have already received 55 different stations."

**W**HILE some of our readers have written that they have obtained loud-speaker volume with the one-tube set on local stations, such results can be obtained with one tube only when the broadcasting station is less than five miles away and the receiver is connected with a good outdoor antenna. The logical way to obtain loud-speaker volume is to build a good audio amplifier and connect it with the one-tube receiver. Such an amplifier is illustrated in Fig. 4 (described completely in POPULAR SCIENCE MONTHLY for June, 1925, and shown in detail in Blueprint No. 42).

Large numbers of radio fans who built the one-tube receiver since have added the amplifier. A radio constructor from Los Angeles, Calif., writes:

"I made the one-tube set you published in the May issue and will say it is the best one-tube set I have met with and now I want to make the coupled resistance amplifier and will ask you where the variable resistance unit for panel mounting is to be had."

This amplifier unit has three features of particular importance: First, it is extremely easy to assemble and wire. Second, it reproduces with remarkable quality and clearness, and third, it will not squeal or howl, provided that

### Blueprints Available

**D**ETAILED working blueprints for the construction of the three radio units discussed on these pages are available, and will be found listed among the POPULAR SCIENCE MONTHLY blueprints on page 87 of this issue. Blueprint No. 41 is for the one-tube receiver shown in Fig. 5. No. 42 for the amplifier unit shown in Fig. 4; No. 43 for the four-tube receiver shown in Fig. 3.

all the connections are made correctly

When the one-tube receiver and the audio amplifier are combined, as shown in Fig. 2, at top of previous page, they will bring in stations and put them on the loudspeaker in a way that will satisfy most radio fans completely. This is true only when a good outdoor antenna can be used.

**M**ANY readers have asked what advantage there would be in building the four-tube receiver illustrated in Figs 1 and 3 (described completely in POPULAR SCIENCE MONTHLY for July, 1925, and shown in detail in Blueprint No. 43)

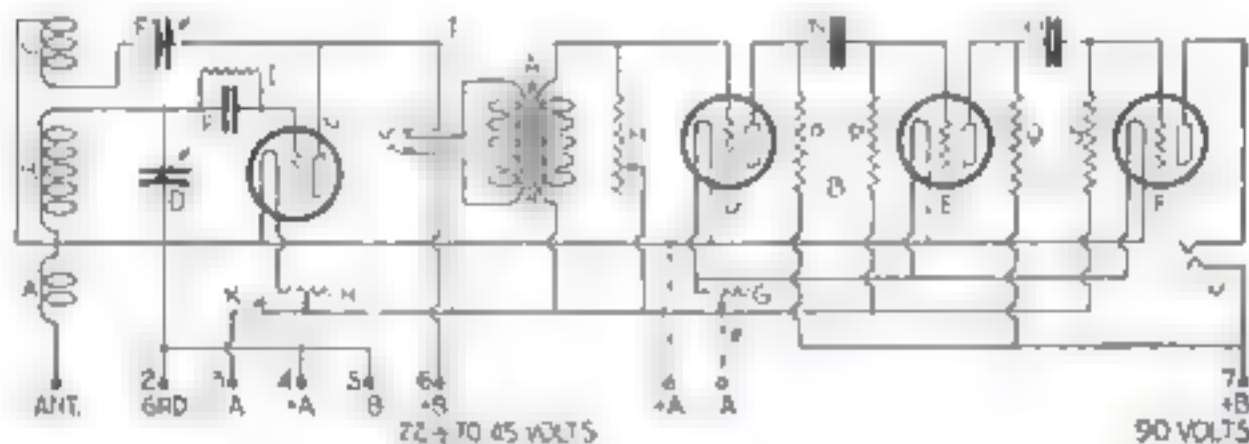
They want to know why they should build this set if practically the same results can be obtained by combining the one-tube receiver with the three-tube amplifier unit.

The answer is that the four-tube receiver of Blueprint No. 43 is more sensitive and more selective. This means that, other conditions being equal, the four-tube outfit will bring in stations from a greater distance and do a better job of cutting out local interference. If the radio fan finds that these two qualities are needed to a greater degree in order to give him the kind of radio reception he wants, then the four-tube receiver is distinctly worth while. On the other hand, the four-tube outfit is not quite as easy to build and get going as the simple one-tube receiver plus the amplifier.

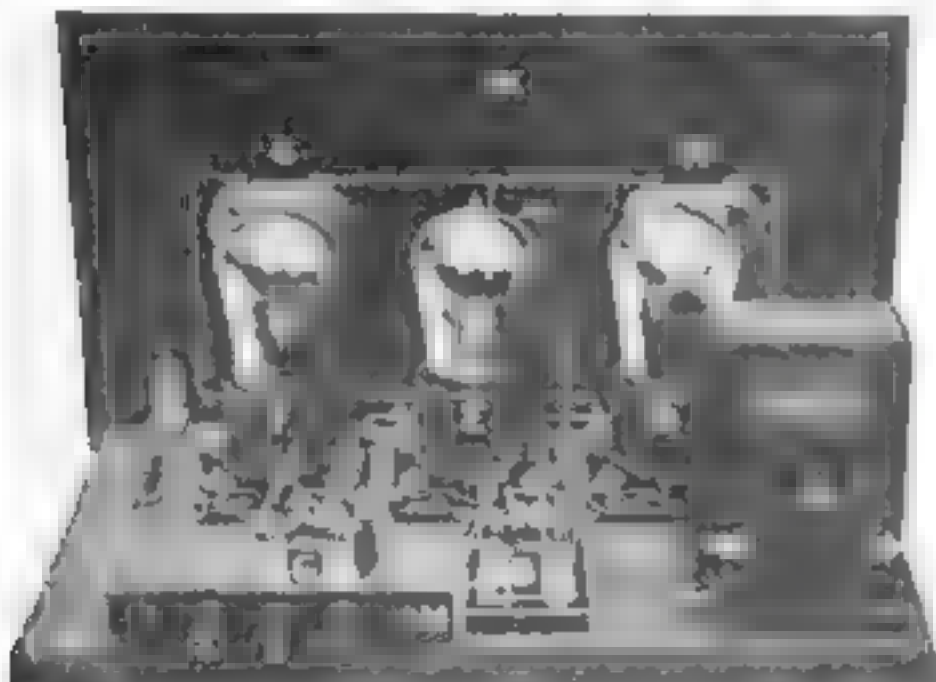
**T**HE beginner at radio construction, therefore, should tackle the one-tube set first. Then, if he wants loudspeaker results, he can add the audio amplifier. These two units also can be combined on one 7-by-24-inch panel. In fact, if the radio fan expects, ultimately, to add the amplifier, it is a good idea to make up the one-tube receiver at one end of a 7-by-24-inch panel and purchase the additional parts for the amplifier later. The wiring diagram of these two units that appear with Figs. 4 and 5, shows just how to connect them properly. Note that seven binding posts are shown with the wiring of the outfit in solid black lines. The battery wiring of the amplifier unit, when made up separately, appears in dotted lines. A vertical dotted line shows the separation of the two units.

Many letters have been received from radio fans who own a pair of .0006-mfd (23-plate) variable condensers, requesting information as to whether these condensers could be used in the one-tube outfit in place of the .00025-mfd, (13-plate) condensers specified.

This change is entirely practical. You must, however, cut down the number of turns in coil R of the one-tube set to about 50 instead of the 68 specified. Depending on the minimum capacity of the larger condenser used, it also may be



This wiring diagram shows how the one-tube receiver and amplifier unit below are combined



**Fig. 4. Layout of parts and wiring for the three-stage amplifier unit described in our June issue which the beginner can construct easily and add to the one-tube receiver shown in Fig. 5. In the combined wiring diagram above this unit is shown at the right**

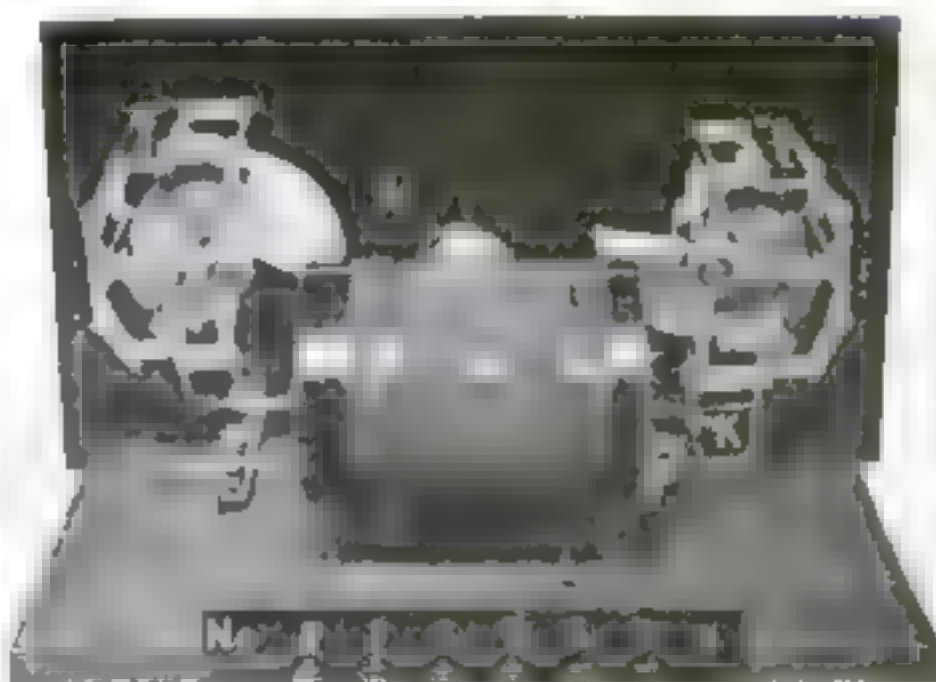


Fig. 5. Arrangement of parts for the one-tube long-distance receiver described in our May issue—a set simple for the beginner to build. In the wiring diagram this unit is shown at the left of the dotted line. Blueprints for both units are available.



# New Life for Your Radio Tubes

*Remarkable Tests by Popular Science Institute of Standards  
Show How Worn-Out Filaments Can Be Rejuvenated*

**R**ADIO vacuum tubes always seem to fall when least expected. A favorite time, apparently, for a tube to burn out or go dead is when you are trying to demonstrate the remarkable qualities of your radio set to some friend. The music starts off with a grand flourish and then suddenly stops completely or fades nearly away.

A vacuum tube that has burned out is beyond recall, of course, but thousands of radio fans do not know that vacuum tubes that have gone dead may be revived. This applies both to tubes that have worn out in service and to tubes that have become paralyzed through the use of too high B-battery voltage or from burning them too brightly in an effort to increase the volume.

Practically all the standard vacuum tubes are what the English call "dull emitters." In other words, the filaments of modern tubes are coated with a substance that gives off a plentiful supply of electrons when heated to a temperature just beyond the dull red point. This material exists on the surface of the filament as an exceedingly thin layer and if the tube is forced beyond the proper limits, the material is exhausted faster than it can be replaced from within the filament itself.

**C**URIOSLY enough, the way to give your tubes new life is to force them—sort of a "fighting fire with fire" proposition. The forcing process, however, is applied to the filament alone, and the B battery must be disconnected entirely.

In theory, at least, the way to revive radio tubes is to heat the filament to a temperature considerably above the normal. This excess heat appears to have the effect of forcing more of the material to the surface; and since the B battery is disconnected, the material is not used up and accumulates where it can be of use when the tube again is put back in service.

Obviously, no radio tube will last forever. Some tubes will stand the rejuvenation process several times, others only once or twice; but it is safe to estimate that the average life of a modern vacuum tube can be prolonged greatly.

There are three ways in which the coating on the filament can be renewed. To determine the relative effectiveness of these various methods, the Popular Science Institute of Standards Radio Laboratory has just concluded a series of important tests.

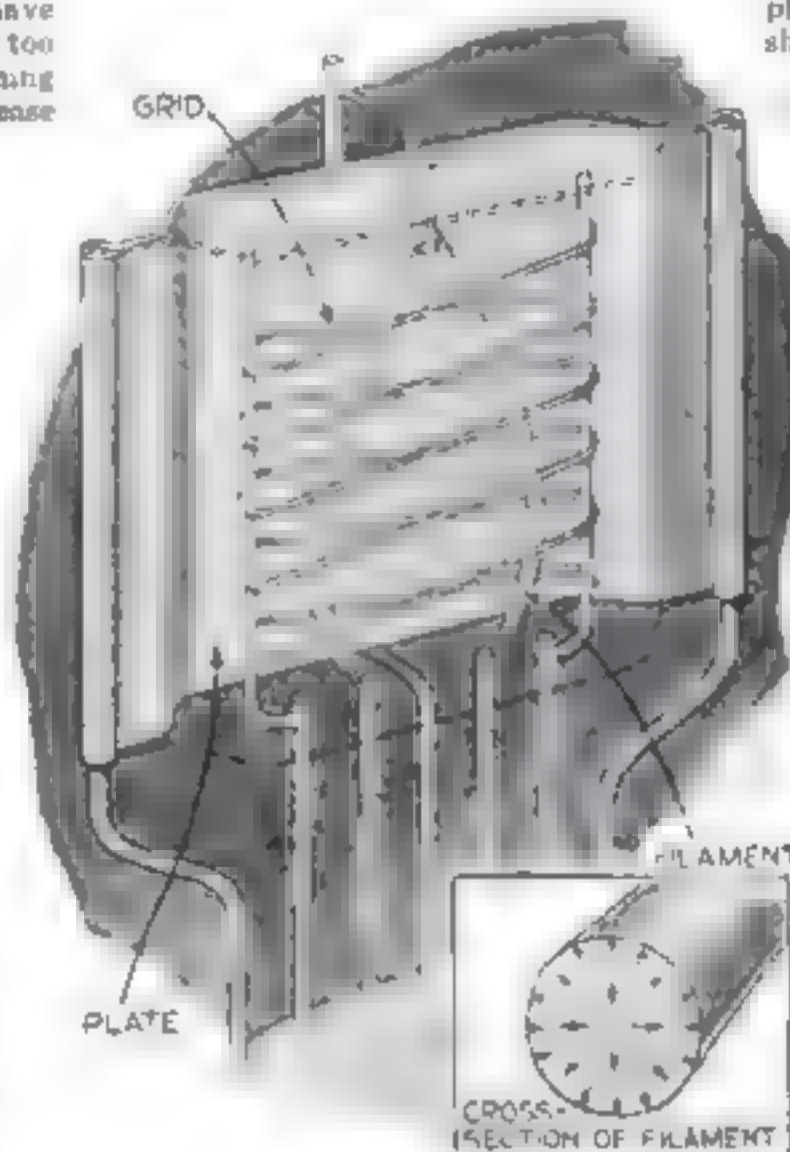
The three possible methods are these:

1. Operate the vacuum-tube filament at normal rated voltage for several hours with the B battery disconnected.
2. The use of a device designed especially for the purpose. It consists, essen-

**By Eugene Bruyning**

*Member of the Staff of the  
Popular Science  
Institute of Standards*

tially, of an alternating-current transformer arranged so that a pressure of 17 volts may be applied to the filament of the standard storage-battery tube. The filament is operated at this voltage for 45 seconds, then a switch is thrown that connects the filament with another tap on the transformer, giving eight volts. At this



## How Vacuum Tubes Are Rejuvenated

This diagram of the working parts of a radio tube shows how the filament is surrounded by the grid and the plate. When the filament is heated carefully to a temperature higher than normal the material that gives off electrons is forced to the surface as indicated by the arrows in the inset. The B battery must be disconnected.

voltage the tube is allowed to burn for 10 minutes. This device operates from the electric-light socket.

3. The use of batteries to operate the filament for 45 seconds at from 12 to 17 volts, followed by 10 minutes at from six to eight volts.

To start with, in the Institute laboratory tests, we took two new standard storage-battery tubes and paralyzed them so that the plate current on 90 volts with zero grid potential dropped from 7.5 to .1 milliamperes. This was done by applying a very high filament voltage while the

B battery was connected. In other words, we put the tubes in such condition that they were of no further use for radio either as detectors or amplifiers.

One of these two tubes then was treated by the first method. After an hour or two we found that it was restored to the point where the plate current was 5.2 milliamperes, sufficient for radio work, but was not quite as good as new.

**T**HE other tube was treated by the second method, using a standard tube rejuvenator. After treatment the plate current was 8.4 milliamperes—just a shade better than new.

This test, with several others, proved conclusively that paralyzed radio vacuum tubes could be restored to usefulness.

Next we wanted to see what the rejuvenation process could do for tubes that just naturally had given out through long service in a radio receiver.

In the continual testing of receivers, loudspeakers, and other radio apparatus at the Institute laboratory, tubes often are worn out completely in a few weeks or a month.

We took four of these "dead" tubes and treated one by the first method, another by the second. The remaining two tubes were treated by the third method. All the tubes came back to life. They were equally good except the one treated by the first method. This one did not show up quite so well.

**T**HESE tests show that adding life to your radio tubes by the rejuvenation process is a distinctly practical and money-saving process.

A comparison of our results would indicate that the use of a special alternating-current tube rejuvenator is, perhaps, the most practical

way for the average radio fan. Equally good results can be obtained by use of direct current from batteries, but most radio fans have no batteries available that will give the requisite voltages. Then, too, there is always the chance of burning out your tubes if you do not happen to hit the right combination: an accident which is not likely to happen with the special devices.

In addition to our experiments with standard storage-battery tubes, we also tried out the effect of rejuvenation on three-volt type dry-cell tubes. The results were substantially the same as for storage-battery tubes. Of course the voltages applied to the filaments of dry-cell tubes were considerably lower than for storage-battery tubes. Nine volts, for instance, is about the right amount for tubes of the three-volt type, with from three to four volts during second period.



# Newest *Inventions* and *Oddities* in Radio



## Percolator Tops for Insulators

Here are the lead-in insulators used at one of the New York City broadcasting stations. They are made of glass. Two are used for each wire, one inside and one outside, held in place by a long brass bolt that provides a path for the current.



## Receiver Uses House Current

Benjamin F. Miesmer, well-known radio engineer of New York City, has completed the development of a remarkable new receiver that runs from any electric-light socket. No A or B batteries are needed for this.



## The Man Who Gave Us the Neutrodyne

Professor L. A. Hazeltine, the man who discovered the principle of the neutrodyne receiver, is the head of the Department of Electrical Engineering at Stevens Institute of Technology. It is said that Professor Hazeltine made his important discovery entirely by mathematical deduction. The principle of the neutrodyne as developed by Professor Hazeltine is to use a small adjustable capacity arranged in the circuit in such a way that it balances the internal capacity of the tube elements and thus prevents the tube from oscillating.



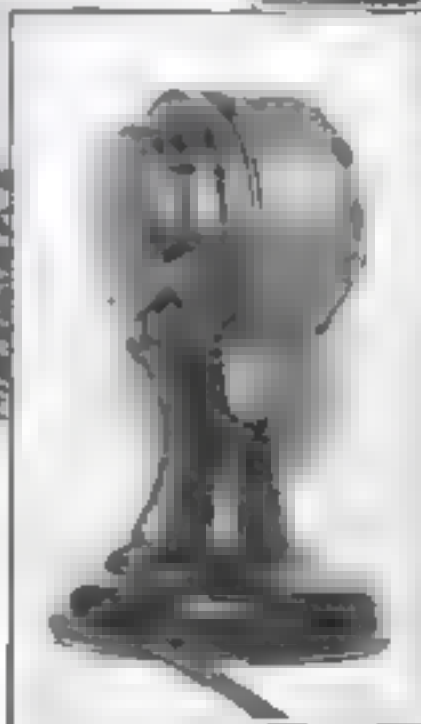
## College Students Make Vacuum Tubes

The laboratories of Cornell are so complete that the students are able to construct even the vacuum tubes used in their radio work and experiments. The illustration shows Professor B. R. Northrop demonstrating the blowing apparatus.



## Unbreakable Tubes

Here is Herbert H. Metcalfe demonstrating a new vacuum tube so tough that even a sharp blow will not break the filament. These tubes can be dropped to the floor without any injury.

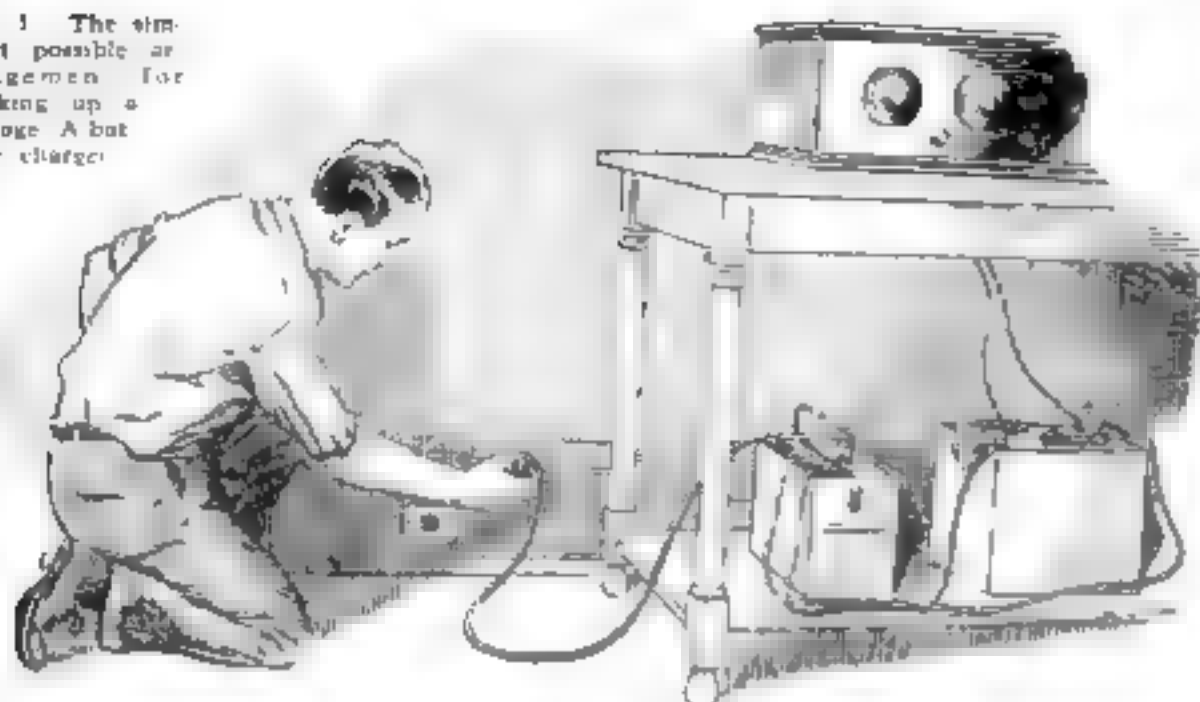


## Table Loudspeaker

It is possible, as shown at left, to build a practical and satisfactory radio table-talker out of the frame and pedestal of an old electric fan. The ventilating holes in the frame serve as openings for the incoming sound.



Fig. 1 The simplest possible arrangement for hooking up a storage A battery charger



# How to Charge Your Radio Batteries

*Simple Methods of Installation that Will Save Time and Trouble*

By John Carr

**T**HE trouble and inconvenience of charging radio storage batteries has been greatly exaggerated. Of course, in the days before efficient home chargers were available, the sight of a neighboring radio fan laboriously struggling down the street with 100 pounds or so of battery on his way to a battery service station was enough to deter almost anybody from buying a radio set. But carrying your storage battery to the nearest garage or service station no longer is necessary. Batteries can be charged at home easily, simply, and cheaply. The only prerequisite is that your home be wired for electricity.

Since perhaps 90 per cent of the homes in this country that are wired for electricity are supplied with alternating current, methods for charging storage batteries using this type of current will be discussed in this article.

Storage batteries produce perfectly uniform direct current. Consequently they must be charged by means of a direct current, although the charging current need not be uniform in character. Alternating current, as supplied to your home over the electric-light wires, cannot be used.

Although there is no essential difference in the kind of current needed to charge storage A batteries as compared with that needed for storage B batteries, there is considerable difference in the volume of current and the pressure at which it must be supplied to the two types of batteries. A batteries need large volume at low pressure, while B batteries can be charged only with a small volume of current at much higher pressure.

**T**HERE are on the market at present three distinct types of A-battery chargers. In each a transformer is used to step down the 110-volt lighting current to a lower voltage suitable for A-battery charging. One type uses a special kind of vacuum tube to rectify this lower voltage current before sending it through the storage battery. Another rectifies with an electrolytic cell, and the third uses a vibrating contact arm which is so made that it swings in time with the 60-cycle alternating current. All three types will give good service if properly constructed.

The proper method of connecting the charger with your A battery depends, of course, on the type of charger and the internal connections of the receiver. This is true only when you make a permanent installation controlled by switches arranged so that it is only a matter of throwing a switch to put your battery on charge. With some types of chargers a very simple switch system will give satis-

faction, while the same system, used with another charger, may result in burning out your fuses or blowing out the tubes in the receiver.

In addition to this possibility, the problem of arranging a hook-up for the A-battery charger is complicated further by the fact that several types of battery chargers are made to charge storage B batteries as well as A batteries.

**FIGURE 1** shows the simplest possible arrangement. It will work perfectly with the electrolytic type of A-battery charger. It can be used also on the newer bulb-type chargers, which are made so that there is no metallic contact between the primary windings of the step-down transformer and the secondary circuits. Figure 2 shows the proper circuit to be used with older types of bulb chargers and all types of chargers employing a vibrator. Figure 3 is a simple hook-up for the new type of bulb chargers, which are arranged to charge both A and B batteries. This circuit will work regardless of whether the minus B-battery connection in your receiver is made to the plus or minus A circuit.

Chargers made especially to recharge storage B batteries are available in two forms—the vibrator type and the electrolytic cell, as supplied under various

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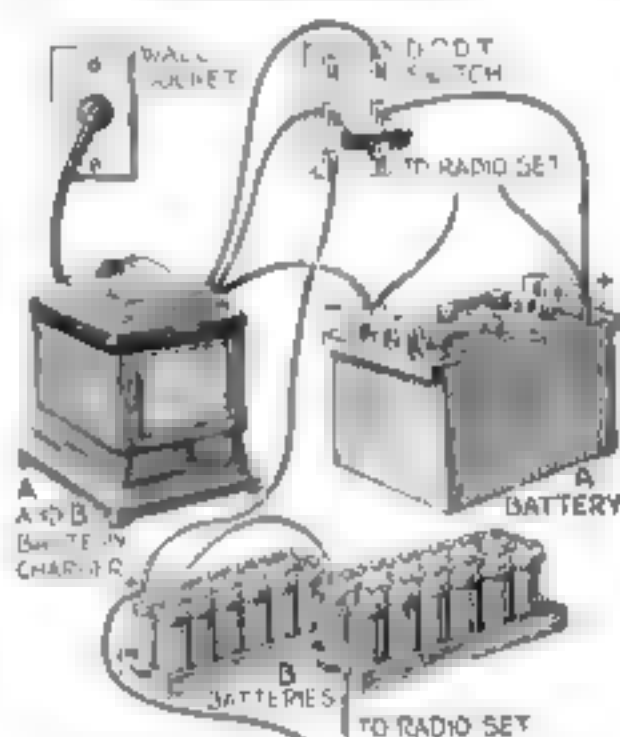


Fig. 3 A simple hook-up for the new type of bulb chargers, which are arranged to charge both A and B batteries

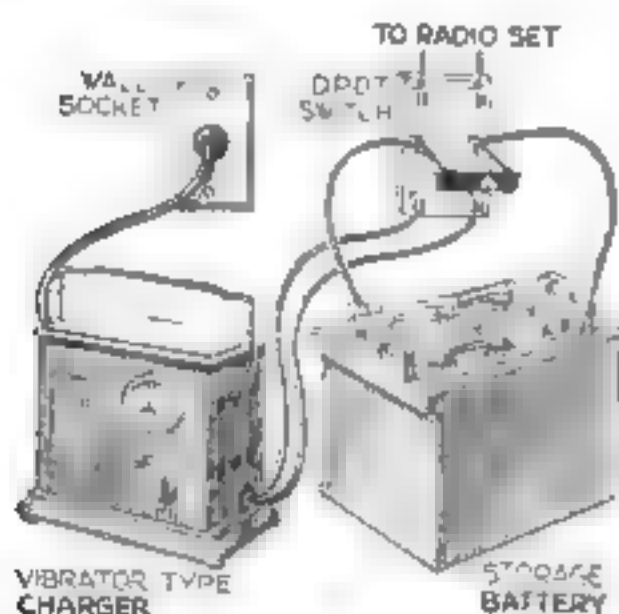


Fig. 2 The correct circuit to use with the older types of bulb chargers and with all types of chargers employing a vibrator

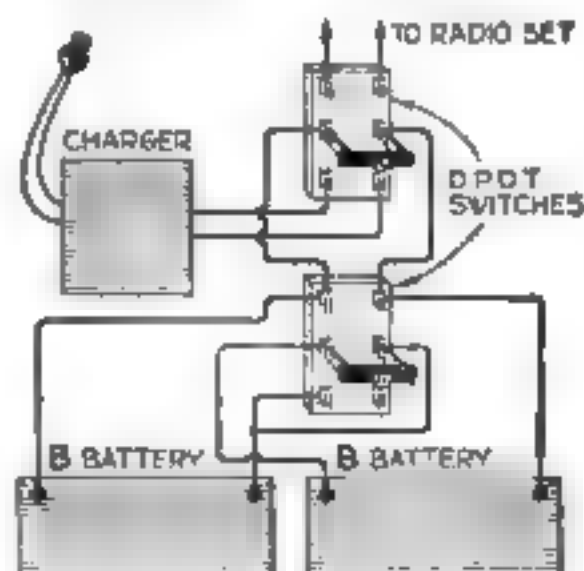
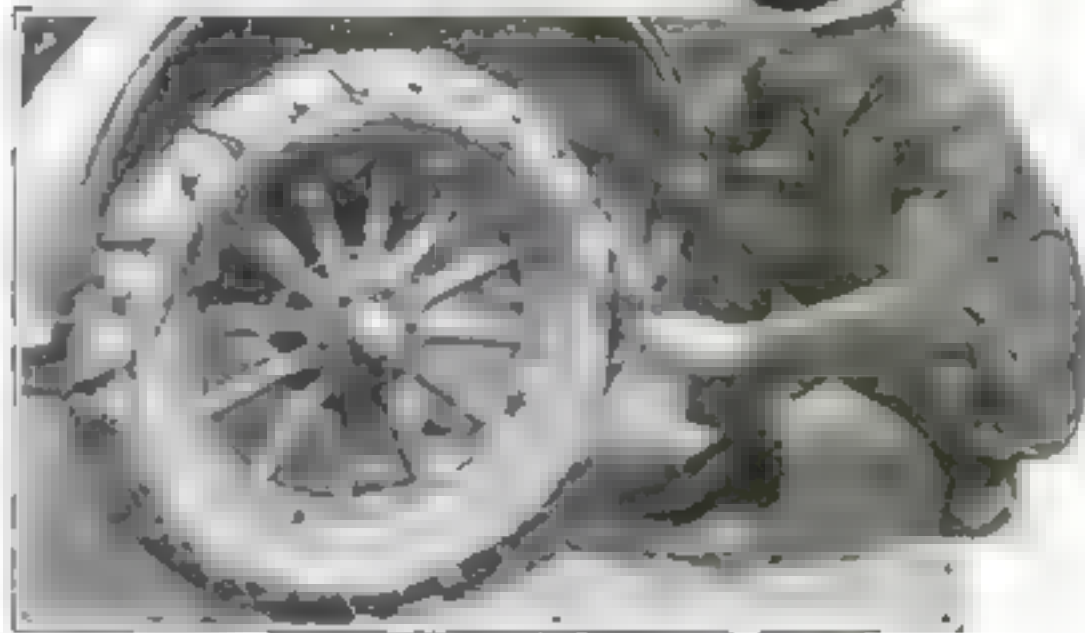


Fig. 4 This arrangement using two double pole double-throw switches, permits disconnecting the B battery from receiver connecting it with charger, and also arranging the two halves of the battery in parallel for charging



# For Well Equipped Cars

*Half a Dozen Ingenious  
New Ideas to Increase  
the Motorist's Comfort*



**Rubber Skid Chains Save Tires**

Instead of the usual metal links, the cross pieces of this skid chain are made of rubber. Steel side chains hold the rubber cross chains in place. It is claimed the new chain works effectively, except when used on icy streets.



**Electric Jack Saves Work**

Every auto-owner who has had tire trouble on a country road knows that jacking up a heavy car is quite a job. And this is particularly true if the punctured tire is on one of the rear wheels, because of the difficulty of reaching under the car. This ingenious new electric jack makes the auto storage battery do all the work.



**Mudguard Flag Holder**

For motorists who like to display flags attached to their cars on national holidays, the device at the left solves the problem simply. It can be clamped to the edge of the mudguard and set to hold the flag in a vertical position. It is padded to protect the car finish.

**A High-Pressure Grease-Gun**

Sometimes a grease or oil channel becomes clogged and the 500 pounds pressure developed by the ordinary grease-gun fails to clear the obstruction. The device shown at the right boosts the pressure up to 5000 pounds, sufficient to force grease through.



**Spotlight Controlled Inside**

As the illustration shows, this remarkable spotlight is mounted on the end of a hollow shaft. At the other end of the shaft, inside the car, there is a knob. Moving the knob up and down shifts the position of the spotlight vertically, while horizontal swing is governed by turning the knob on its shaft. The inner shaft is, of course, used to transmit all motion to the spotlight from the knob near the steering-wheel of the car so that there is absolutely no chance for play to develop.

**Radiator Cap Includes Clock**

This unique radiator cap combines three functions. It tells the time by means of the clock in the center. A thermometer indicates temperature of water in the radiator. At the left another indicator determines the amount of water inside.





# Gus Reveals Some Tire Secrets

*His Easy Ways to Make Roadside Repairs Save a Lot of Time*



A Flat Tire—and the Jack Is Missing!

Gus sat on a rock and bowed the job while Joe repaired a punctured clincher tire without jacking up the wheel. The tire was mended quickly and easily with the aid of nothing but tire irons and a "sizzle patch."

By Martin Bunn

"GOOD MORNING, Gus—what do you know about real estate?" said Joe Clark to his partner, just as the latter was unlocking the door of the Model Garage.

"Not a darn thing at this time of day," Gus growled crossly and a bit sleepily.

"Oh! All right, you old grouchy!" grinned Joe. "I only wanted to tell you that there's a house up my way that I want to buy. I thought maybe you'd take a run up there with me and tell me if it's a bargain."

"Humph!" grunted Gus. "One of those places over on Biddle Avenue, I suppose?"

"No, sir!" answered Joe emphatically. "This one is on East Main Street."

"I don't know anything about those houses," said Gus, showing a bit more interest. "Suppose we take a run up there this afternoon and give it the once over. The kid can take care of the gasoline pump, and business is slack now anyway."

Along about half-past three Joe suggested that it was time to start, and the two men climbed into Joe's flyver and started off, leaving Hal, the kid who did odd jobs around the garage, standing importantly beside the gasoline pump. This was the first time he had been left in charge of the place, and he was as proud as a peacock.

"Gosh!" exclaimed Joe, as they rattled down the road. "This boat certainly does steer hard. I can barely keep it on the road."

Gus looked at his partner with a pained expression on his face.

"Son," he said, "as a bookkeeper you are a whiz, but you are surely a dummy about autos. Haven't you seen that this bus rides as rough as a broncho? I was just waiting for you to notice that your right front tire is almost flat! I suppose it would have to come right off the wheel before you'd get wise."

Joe appeared decidedly crestfallen as he stopped the car at the side of the road. And his face registered downright chagrin when he discovered that the jack was missing from the toolkit.

"Whatever became of that jack, I wonder?" he muttered disgustedly. "Now I suppose we will have to run back to the garage on the flat tire and run it in the process."

GUS meanwhile had been poking around in the toolkit.

"Drive back nothing!" he said emphatically. "What do you suppose these 'sizzle patches' are for, except to repair flat tires with?"

"Sure, I know what they are for," said Joe; "but what good are they to us if we have no jack to take off the tire?"

"Don't worry about that," replied Gus; "just you get behind this bus and push it along slow so I can see if I can locate the hole."

Gus kept a sharp watch on the slowly revolving front tire and his keen eyes soon spotted the head of what turned out to be

an extra long carpet tack in the rubber. "Now," he said, "this is your car and I am going to light my pipe and boss the job while you do all the work. Get out your tire irons, the clamp, and sizzle patches."

JOE did as directed, for he long since had learned that when Gus said he knew how a thing could be done, he was pretty sure to be right.

While he was locating the iron, Gus filled his pipe and settled himself comfortably on a near-by rock.

"Get busy with the irons now and pry off the bead of the tire right where we pulled out the tack and for eight or 10 inches on each side of the puncture. That's the idea," he nodded, after a few minutes of strenuous work on Joe's part. "Now pull out the tube and find the hole."

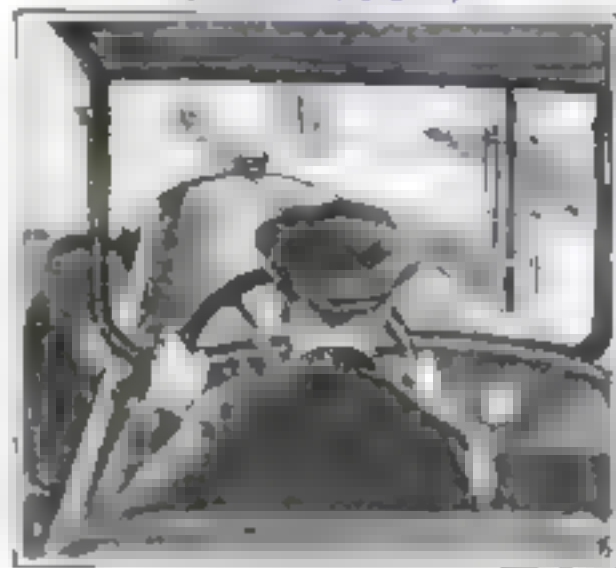
Joe meekly followed directions and when he had found the puncture in the tube, he proceeded to scrub the surface of the rubber surrounding it with a rag dipped in gasoline from the tank, tore off the protecting paper from the uncured rubber on the bottom of the tin sizzle patch, clamped it firmly in place over the hole, and finally touched a match to a corner of the brown cardboard-like substance, which immediately started to sizzle and fume like a firecracker fuse.

GUS settled back to enjoy his pipe while the patch was cooling.

"In five minutes, or thereabouts, we should be on our way," he said. "And you will kindly notice, Joe, that we did not need the jack after all. Of course, you couldn't do that with a straight side tire, but it's a handy kink to know if you own a light car fitted with clincher tires."

After waiting the prescribed time, Joe pushed the tube back into the shoe, pried the head on the rim, pumped up the tire,

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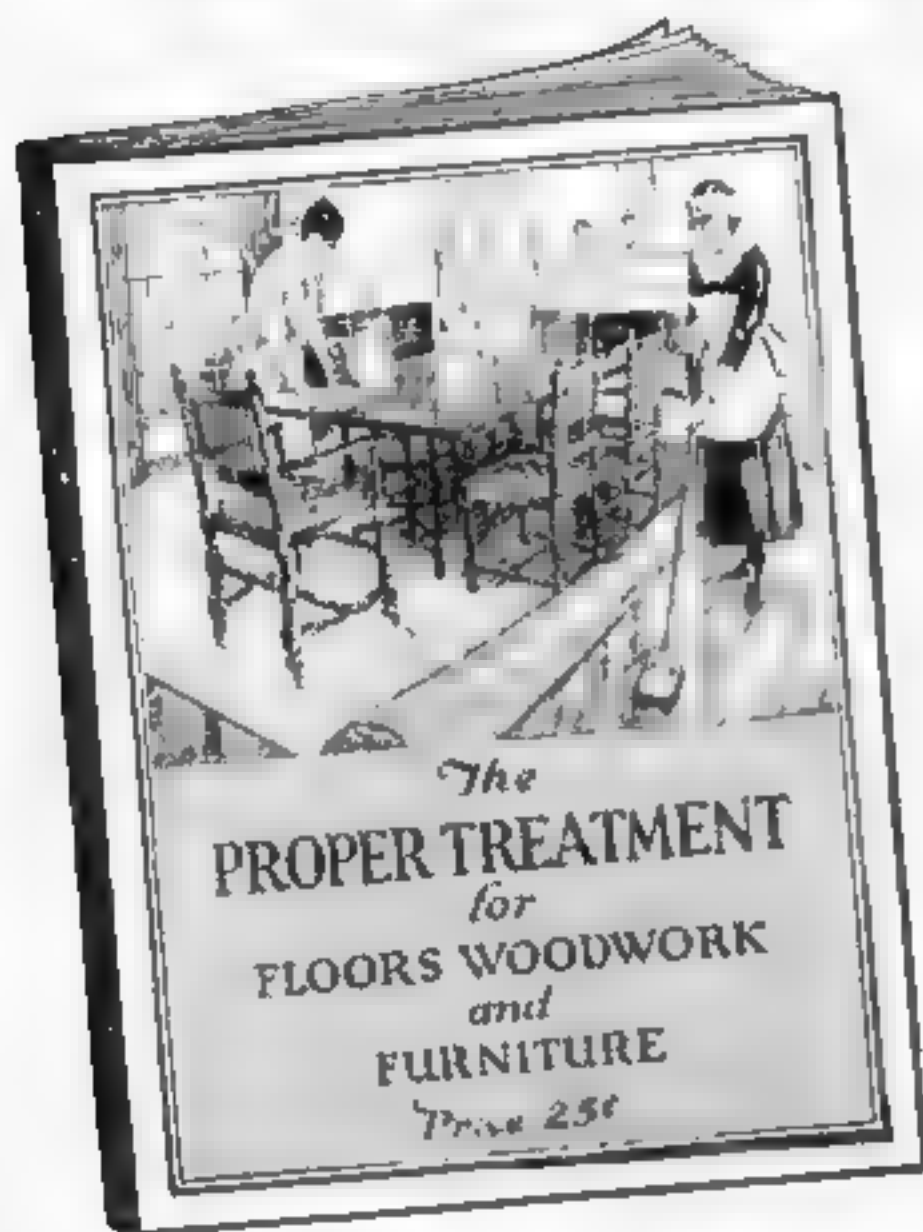


A Sure Guide for Parking

To avoid strapping tires against the curb in parking, Joe invented an ingenious scheme for gauging distance. With his car parked correctly he got in the driver's seat and observed just where the curb line appeared in relation to the top of the radiator. After that it was a simple matter to judge the distance from the curb by repeating the same line-up when he drew up to the edge.



# FREE—Valuable Instruction Book on Wood Finishing



It tells how inexpensive soft woods such as pine, cypress, birch, fir, etc., may be finished so they are as beautiful and artistic as expensive hard woods.

Tells how you can easily and economically put furniture, floors and woodwork in perfect condition. How to finish wood in beautiful stained effects with Johnson's Wood Dye and in up-to-date enamel effects with Johnson's Enamel.

## How to Get it—FREE

Ask your best paint or hardware dealer for a FREE copy of the Johnson 25c Book on Wood Finishing. If your dealer cannot furnish this Book—mail the coupon to us, giving the name of your dealer, and we will gladly send you a copy free and postpaid.

This book is the work of experts—profusely illustrated in color.

# JOHNSON'S WOOD DYE

## Penetrating

Dark Oak  
Fumed Oak  
Dark Mahogany  
Light Mahogany

Light Oak  
Golden Oak  
Mission Oak  
Weathered Oak

Walnut  
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Johnson's Wood Dye is very simple to apply—it goes on easily and quickly without a lap or a streak. Dries in four hours and will not rub off or smudge—penetrates deeply, bringing out the beauty of the grain without raising it in the slightest. All shades of Johnson's Wood Dye may be easily lightened or darkened.

Johnson's Wood Dye is a dye in every sense of the word. It penetrates so deeply that the natural color of the wood is not disclosed. Like most first class products Johnson's Wood Dye answers one purpose only—it dyes the wood; a finish must be applied over it—we recommend Johnson's Varnishes or Johnson's Polishing Wax.

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The sign at the left distinguishes the Wood Finishing Specialist from the ordinary paint store. All stores displaying this sign carry a full line of Johnson's Artistic Interior Wood Finishes. They will gladly give you a FREE copy of the Johnson 25c Book on Wood Finishing and are competent to answer questions and give advice on the proper finishing of wood. Ask them to show you wood panels finished the "Johnson way".

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City and State \_\_\_\_\_

Dealer's Name \_\_\_\_\_



(Continued from page 64)

and they proceeded on their journey.

Soon there came the sound of a motor horn. Gus looked around to see who it was trying to pass.

"It's old Mr. Conklin," he said. "Give him plenty of room. The old duffer can't see well, and he's liable to tear off a mudguard for you."

Joe pulled over close to the edge of the road and Conklin rolled by.

"Look!" exclaimed Joe. "He has a flat tire too!"

"Give her the juice!" Gus called out sharply. "That's a new tire he bought from us. We can't let him ruin it."

JOE opened the throttle and the little car quickly picked up speed. The chase scarcely had begun, though, when there came a resounding report from the car ahead.

"Now I suppose he'll blame us for selling him a defective tire," Gus grunted. "Well, pull in behind him. We might as well take our medicine."

But this time, both Gus and Joe were wrong. The soft tire had not blown out. It was, instead, an old tire on the right front wheel of Conklin's car that finally had let go.

Conklin was climbing out as the little car pulled in behind him.

"Hello," he hailed them. "You arrived just in time. You can help me change tires."

"That's why we were trailing you," said Gus.

"How did you know I was going to have a blow-out?" asked the other in surprise.

"I didn't, but your left rear tire is almost flat. We were trying to overtake and warn you when the other one surprised us by blowing out."

Conklin swung around with a grunt.

"More bad luck," he said gloomily. "Two flat tires and only one spare. What am I going to do about it?"

"Nothing to it," said Gus. "Put the spare on in place of the blown-out front shoe, and we'll fix this soft one for you. Got a jack in your toolkit?"

CONKLIN produced a jack and a couple of spindly little tire irons about eight inches long.

Gus looked disgustedly at the tire irons. "There's a real tire iron," he said, holding up a two-foot length of spring leaf. "You can't do good work on tires without at least one real man-sized iron."

"Look here, Mr. Conklin," Gus continued, as he examined the front tire, "this tire is junk. You have got pretty good mileage out of it, judging from the looks of the tread; but you certainly knocked off at least a thousand miles by scraping against the curbstone so much. See,

the blowout came right where the side wall of the tire was worn nearly through."

"By jinks, you're right," exclaimed Conklin, bending down and peering over the rims of his glasses at the ugly hole in the side of the casing. "You know, I never can tell when the wheels are close to the curb, and what with all these new-fangled regulations about parking close to the curb, the only way I can be sure is to edge in till I feel the tire scrape."

"Yes," Gus replied, "lots of people have the same trouble. Even Joe, here, wore out a couple of front shoes before he invented a scheme that works fine. Tell him about it, Joe."

"Well, as Gus says, Mr. Conklin," explained Joe, "I couldn't seem to gage the distance from the curb to the tires at all, but finally I hit on a scheme that works out fine. First, you park your car carefully, getting out and ob-

serving its distance from the curb and moving closer or farther away until it's just right. Then you get into the driver's seat, look over the front of the radiator to the point where the street touches the curb and notice just where this line appears in relation to the top of the radiator. After that, all you have to do to park the car at any time is to be sure that you are in the same driving position and watch the curb line and the radiator until they line up right."

"Sounds like a good scheme," said Conklin. "I'll try it out."

BY THIS time, Gus had the blown-out tire off the wheel, and had substituted the spare. Joe tightened up the rim bolts and then jacked up the rear wheel.

"Must be a slow leak," Gus growled disgustedly, as he carefully looked over the tread of the soft rear tire without finding any visible cut or nail in its corrugated surface.

With a hammer, he pounded the lock on the rim around to the open position and then, raising the tire high in the air, he brought it down on the ground with a thump. He made sure, of course, that the point of impact was about six inches from the break in the rim and on the side opposite the locking lever. The jar snapped the rim open and it was then a



#### One Way to Find a Slow Leak

"I didn't see it," said Gus. "I could find it just as well in the dark. The eye is a sensitive organ, and mine felt the small stream of air that was coming out of the tiny hole."

simple matter for Joe to pry the tire off the rim with the erstwhile but treasured spring leaf.

"How are you going to find the leak?" Conklin questioned, as Gus pulled the tube out of the casing. "We haven't any water to put it in and watch for the bubbles."

"That's easy," said Gus smiling; "just watch."

HE PUMPED up the tube to a diameter considerably larger than normal, and then passed the tube, inch by inch, close to his eyes.

"There!" he called out suddenly. "The hole is right here."

"I wish I had eyes like that," said Conklin admiringly, "I never could see a hole as small as that. I even can't see it now you have pointed it out to me."

"I didn't see it either," said Gus. "I could have found it just as well in the dark. The eye is a pretty sensitive organ, and mine felt the small stream of air that was coming out of the hole. Blowing up the tube till it was good and fat stretched the hole so that a lot more air came out than when it was in the tire."

Gus pulled a stubby indelible pencil out of his pocket and carefully ringed the hole on the tube so that he would not lose track of its location. Then the clamp and sizzle patches were brought out again and shortly thereafter Conklin's car was resting on four inflated tires.

"I'M EVER so much obliged," said Conklin gratefully, as he climbed in behind the wheel. "Have another new tire ready for me tomorrow. I'll stop in some time in the morning."

"By the way," he went on, "I've been thinking of fitting the old bus with balloon tires. What do you think of the idea?"

"I don't think much of it," answered Gus candidly. "The tires you have are over-size, and your car isn't heavy, so you can run the tires at fairly low pressure without injuring them. A whole set of balloon tires with new wheels for them would cost you quite a bit of cash. And, besides, the slight improvement in the riding quality would not be worth

(Continued on page 77)



#### A Spring-Leaf Tire Iron

Using an old spring leaf as a tire iron it was a simple matter for Joe to remove the tire of Mr. Conklin's car from its rim. The extra leverage was also a decided advantage.

### Let Gus and Joe Help You!

THE Model Garage is a *real* place, and Gus Wilson and Joe Clark are *real* men, although, of course, fictitious names have been used to disguise the identity of the two veteran automobile men in Mr. Bunn's fascinating series of stories.

Mr. Bunn assures us that Gus and Joe will be glad to answer any questions addressed to them in care of the Automobile Editor.





# For the man who enjoys good tools

## "The Saw Most Carpenters Use"

*Here are the things that prove a saw:*



Balance, hand, easy running—  
Fast, clean, true cutting—  
An edge that holds its keenness—  
Enduring usefulness

Disston D-11. The saw that stands up to all the roughest work.

Disston D-115, the saw for those who want the utmost in finish and accuracy.

Disston D-1. With narrow blade 1 1/4" wide at point. "A" cut.

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THESE are the standards by which Henry Disston judged a saw. The standards to which he himself made the saws that bore his name.

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Eighty-odd years have

gone into the improvement of Henry Disston's methods. Sixty-odd into refining his steel.

Today the Disston Saw is the saw for the lover of good tools. For the carpenter, the mechanic, the farmer, the householder—

For balance; for fast, clean cutting; for lasting keenness; for a lifetime of service.

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*Hardware dealers the world around sell Disston Saws, Tools, and Files*

# DISSTON



# Eight Useful Hints for Autoists

*Timely Precautions Result in a Smooth-Running Car*

**A**FTER several years of service, many automobiles give trouble through overheating. Generally the cause is a clogged radiator and water jacket, although frequently worn rubber hose used to connect the parts of the water circulating system may be to blame. The best way to clean the inside of the radiator and the cylinder water jackets is to flush out the whole system with about five gallons of water in which about a half pound of lye has been dissolved. Fill the radiator with this compound and run the engine until it is hot, then drain the solution off and flush out the radiator several times with fresh water. While you are about it, you may as well clean the cooling fins by squirting water through them with the hose as shown in Fig. 1.

Do not direct the water against the radiator from the outside, as it will be sure to get on the car's ignition system.

**W**HEREVER the roads are soft, automobilists are occasionally in difficulty because the car wheels sink so deeply in the mud. It is usually the custom in such localities to carry a block and tackle.

Figure 2 shows a simpler device. It consists of a wooden trough made of heavy planking. A row of large nails prevents the board from slipping in the soft mud. Wooden cleats should be nailed over the heads of the spikes. They will give traction to the tire and also prevent a puncture.

**S**OME automobiles are not fitted with a petcock between the vacuum tank and the main tank, so the only way to get gasoline out is to disconnect the gasoline pipes. This has its disadvantages, for the connection often leaks when it has been replaced.

If a piece of rubber tubing is available, the gasoline may be siphoned out. The pipe is pushed in slowly through the filler-cap opening until just a couple of inches remain outside of the tank. Then the outer end of the pipe is folded over against itself and held tightly (as shown in Fig. 3) while the other end is pulled out



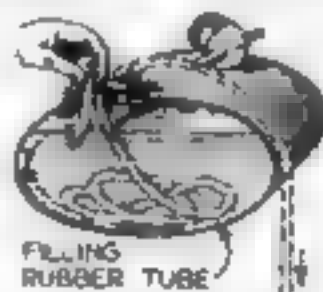
**How to Clean the Radiator**

Fig. 1. In time, engine becomes overheated because of a clogged radiator and water jacket. This picture shows how to flush out the cooling line with fresh water from a hose, the stream being directed outward.



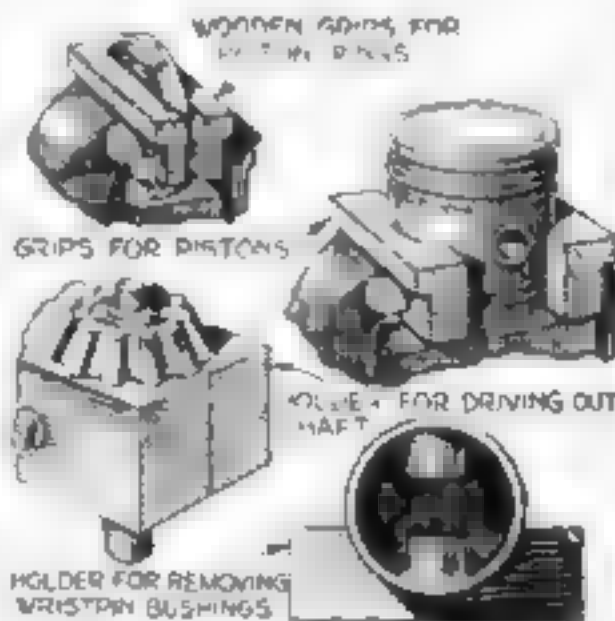
**To Pull Car from Mud**

Fig. 2. Wooden trough is a great help when a car is stuck in the mud.



**A Gas Siphon**

Fig. 3. Rubber tubing bent as shown will siphon gas.



**Wooden Blocks Protect Metal**

Fig. 4. Vise marks on a car indicate carelessness. With a set of wooden blocks, pistons, rings, and gears may be supported, surfaces protected, and breakage reduced.



**Tightening Battery Terminals and a Trouble Light**

Fig. 6. An ordinary iron washer will tighten up a worn tapered lead plug on cable end connecting with battery terminal. Fig. 7. A discarded oilcan makes a satisfactory trouble-light holder with nozzle removed, a standard socket soldered in, and a bulb added.

support various parts. Besides protecting the surface of the part, the wood supports the metal and eliminates chance of breakage.

**T**HE gasoline pipe that leads from the main tank to the carburetor or vacuum tank should be inspected occasionally to make sure that it has not loosened. When this happens, the vibration of the automobile results in continually rubbing the pipe against some part of the car so that the pipe wears thin and a leak develops.

For dependable and easy repair, drain the tank or shut off the valve at the tank end of the pipe line and disconnect the pipe. Scrape the surface of the pipe at the thin point where it has chafed through and tin all around the hole with a hot soldering iron. Next, cut a sleeve of thin sheet brass and bend to fit the pipe. Now tin the inside surface of the sleeve,

place it over the break, and sweat it in place until the solder has run in between sleeve and pipe.

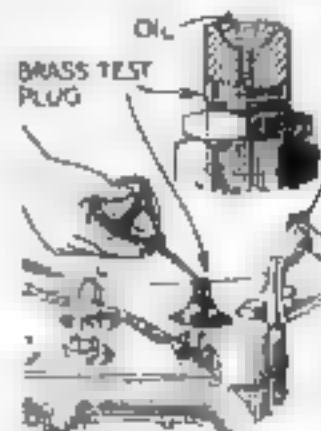
If any part of the car is found rubbing against the pipe, a leak may be avoided by fitting the pipe with a leather sleeve wired on, as shown in Fig. 5.

**T**HE tapered lead plugs on the end of the cables that connect with the storage-battery terminals sometimes become worn. When this happens, use ordinary iron washers around the nut so that the tapered plug will be pulled tightly into the tapered hole in the battery terminal (as in Fig. 6).

**A**N OLD oilcan will make a good trouble-light holder. The nozzle is discarded and the bottom cut out, so that the edges of the hole are round and smooth. A standard socket is soldered in place, as shown in Fig. 7, with a washer for greater security.

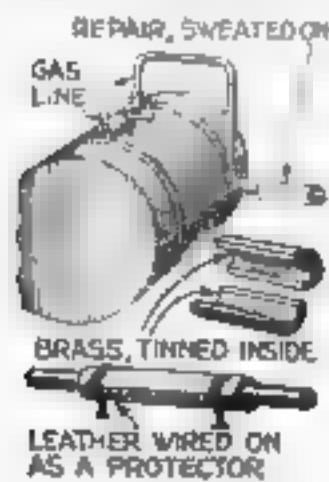
**I**N TIMING the ignition system, it is necessary to determine the piston's top dead center.

A simple and accurate way is to make a test plug of an old spark plug and a piece of brass, as shown in Fig. 8. The brass piece is threaded and after a cup-shaped depression has been cut a small hole is drilled through the piece, using a No. 60 drill. Place a little cylinder oil in the cup and turn the crank slowly. The air in the cylinder will bubble up and stop at the top dead center.



**Piston's Dead Center**

Fig. 8. Spark plug and wire device show piston's top dead center.



**Fixing Gas Pipe**

Fig. 5. A metal or leather sleeve over gas pipe prevents breaks.

and put into the container, which should be as far below the level of the tank as possible.

**V**ISE marks on your work stamp you as a poor mechanic. Always use wooden blocks when you clamp any important part.

Figure 4 shows how to make wooden blocks



# It's mahogany to the eye- but in fact it's Bakelite



So perfectly is the grain and color of mahogany and walnut reproduced in these Bakelite Radio Panels, that the eye cannot distinguish them from the natural woods.

By using a Bakelite Panel that matches the wood in the cabinet, your finished set will be far more handsome than if a plain panel is used.

Rigid and strong, Bakelite Panels support the weight of heavy instruments without sagging. They will not compress, nor cold-flow, under pressure of binding screws. Because of their resistance to extremes of heat, cold and moisture, they will not warp or split. These properties and their insulation value, color and finish are permanent.

Be sure to ask your dealer to show you these wood finish Bakelite Panels—obtainable under any of the following trade-names:

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A Bakelite Panel on a set is an indication that the manufacturer has used the best.

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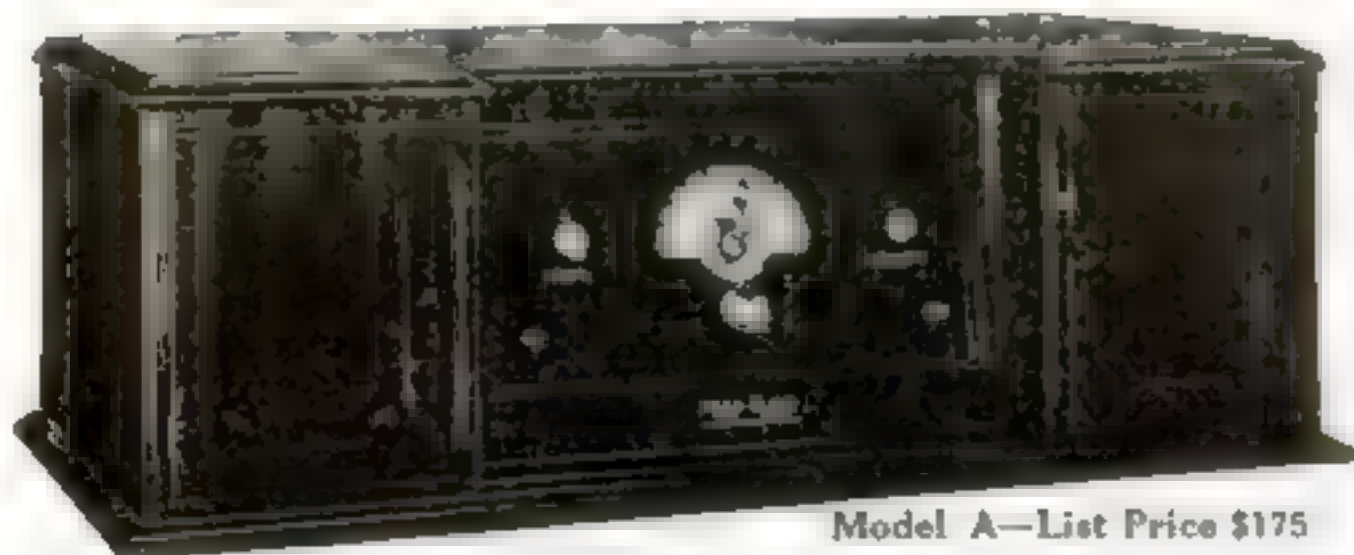
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# Radio's Outstanding Achievement



Model A—List Price \$175

**T**HOSE persons who have delayed buying a Radio Receiver in the belief that "something newer and better" would appear, as well as those who have Radios but are not satisfied with results hitherto obtainable, will find the New Mu-Rad a revelation in the art of radio reception.

This remarkable receiver is the culmination of 8 years of study and laboratory experimentation of the Mu-Rad engineers, plus the knowledge gained by the mistakes and the progress of the entire radio industry.

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is a distinct advance in radio— a year or two ahead of the times. Its ideal circuit embodies two stages of **tuned** Radio Frequency, a Detector and two stages of Audio Frequency.

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A revolutionary feature of the New Mu-Rad is its one dial control. There is only one dial to tune. A slight movement of this beautiful Gold Finish dial brings in one station after another—clear across the continent—without interference from local stations. The dial can be accurately "logged." Stations will always come in at the same dial setting. It's as simple as turning a doorknob.

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# The Home Workshop

Arthur Wakeling, Editor

## A New Way to Cover Cracked Plaster

*How Ceilings and Walls Can Be Repaired with Wallboard at a Relatively Low Cost*

By Edwin M. Love

SO COSTLY and inconvenient are small plastering jobs that the homeowner hesitates to go to the expense of renewing cracked or loosened plaster in his house. By means of wallboard,

however, the handy man can make an unsightly room very attractive. And this can be done at little cost and with a minimum of disorder and dirt.

There are several varieties of wallboard on the market, but those of fiber construction, because of their flexibility and

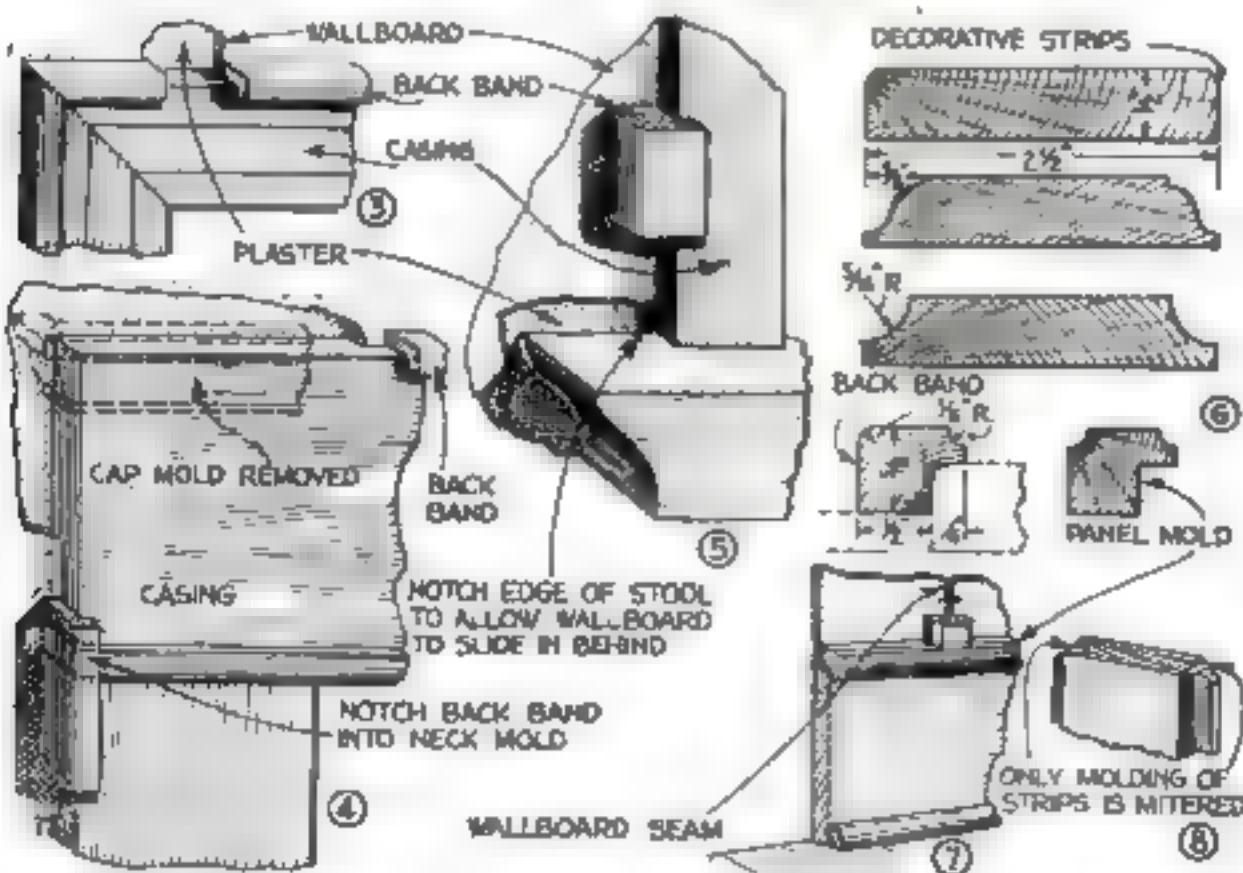
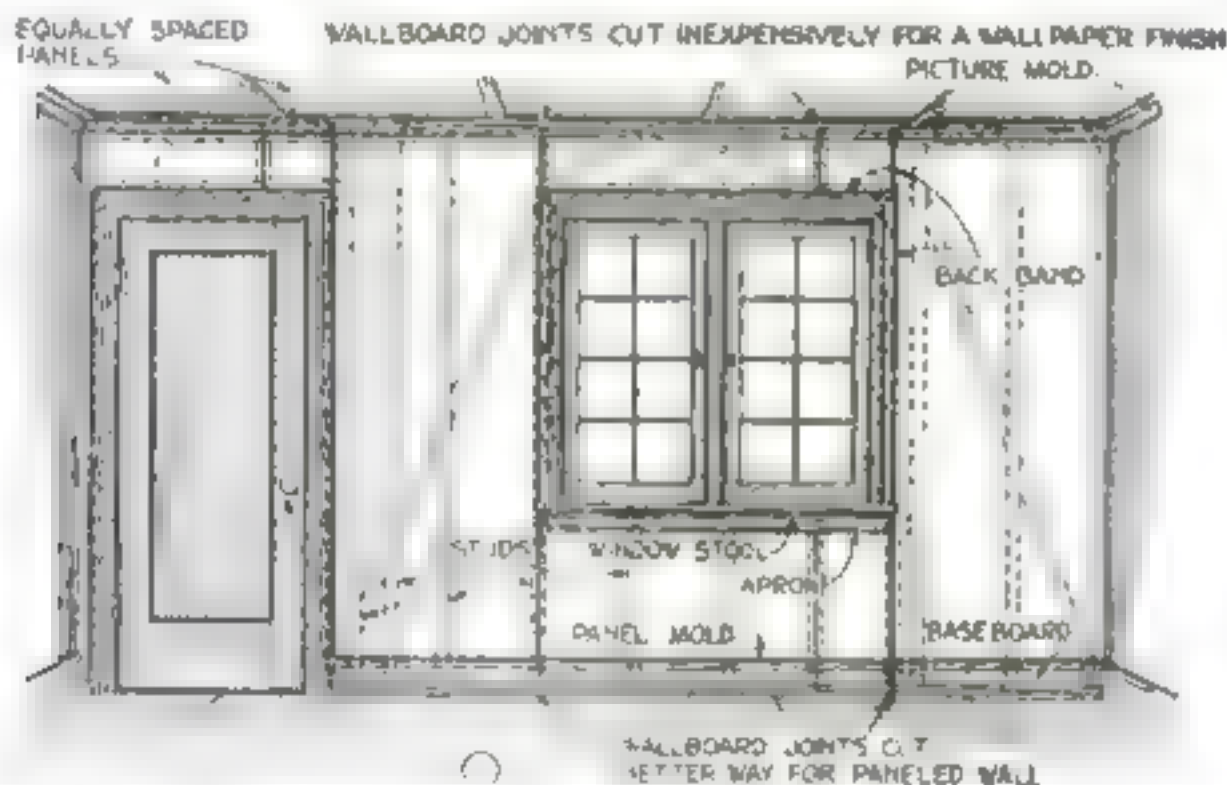


Fig. 2 is a typical wall elevation. Figs. 3, 4, and 5 are details of the trim. Fig. 6 gives molding profiles. Fig. 7 illustrates the base. Fig. 8 shows the end of panel strip ready for joining.

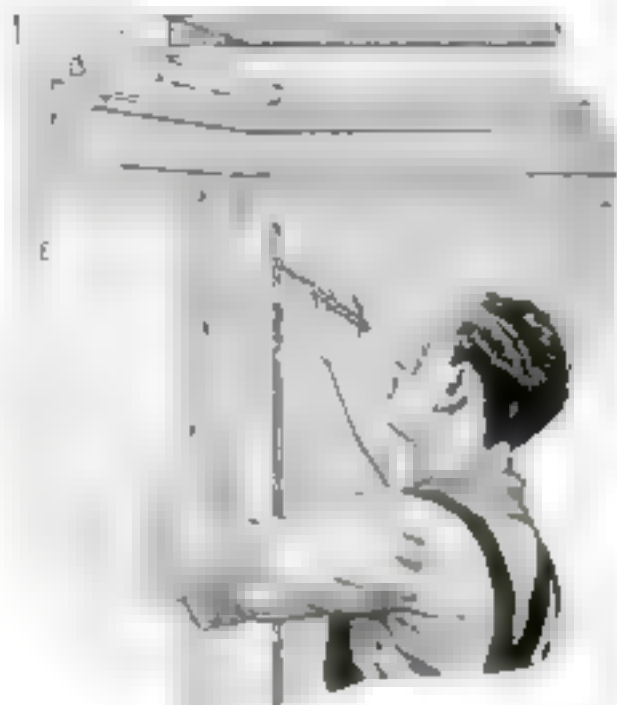


Fig. 1. The 1 by 4 in. furring strip is shown at A, the upper cornice member  $\frac{1}{2}$  by 3 in. at B, the side cornice member at C, the picture molding at D, and the wallboard at E.

lightness, are probably the best for the home mechanic. They usually are made in 4-ft. widths.

If the plaster is attached to the lath with fair solidity, as is generally the case, apply the wallboard over it, otherwise remove it to the lath.

Much wallboard, especially that of the heavy, plaster type, is applied in such a way that the joints can be filled with a plaster composition and the wall then papered. This is, perhaps, the most inexpensive method, but the seams are apt to show through the wallboard in time.

A BETTER method than attempting to paper over the seams is to cover the joints with "batts" or decorative wooden strips to form panels (Fig. 2).

Few rooms are so designed in the grouping of door and window openings that the wall and ceiling panels can be arranged symmetrically and still mate with each other. It is best to divide the ceiling evenly into panels, and group the wall panels according to openings, or else make them fit the ceiling panels regardless of the openings.

Since all wallboard edges must have solid backing, an inexpensive job consists

(Continued on page 123)

This month's Home Workshop will be found on pages 71, 72, 76, to 127, and 131 to 134. The Shipshape Home on pages 128 to 130, and The Better Shop Methods on pages 74 and 135 to 145.



# Is Your *Heating Plant* Ready?

## *How to Put It in Shape for the Coming Winter*

By Lawrence B. Robbins



Unless it was removed and cleaned in the spring, take down the smoke pipe, rap it with a stick to loosen the accumulated scale, and then scrape or brush out all the soot.



The end of the smoke pipe should not project into the chimney more than the width of a single brick.



The register box of a "pipeless" furnace is a dust catcher and should be cleaned thoroughly. Small registers and air pipes should be dusted every few years.



Any section of the smoke pipe that is badly rusted or crumpled should be replaced. When the smoke pipe is replaced, there will be no danger of the furnace opening.

At the bottom of the furnace, a hole should be made for the escape of gas. It must be sealed with a material that will not burn.



Open the furnace door and clean out the interior. As the furnace is cleaned, the gas valve should be closed and the furnace should be sealed.



Broken asbestos insulation should be patched with a paste of asbestos meal and water.



Cover steam or hot-water pipes with asbestos paste or cellular insulation.



If any of the grate bars are burned or broken, they should be replaced with new ones; not a difficult job.

**BY** HAVING your boiler or furnace thoroughly clean, even to the most inaccessible places, you can save anywhere from one-half to four tons of coal a season.

It is advisable to dust between the radiator sections and even to remove the outer casing of a hot-air furnace, so that

the heating surfaces can be well brushed. The cold-air box should be cleaned and the air-inlet screen freed from rubbish.

If you have a hot-water or steam plant, drain off the water until it runs clear. If there is much sediment, empty and flush the boiler.

A steam boiler should be refilled until

the gage is half full with water; in a hot water system, until the gage on the expansion tank shows one-quarter or one-third full.

Joints between the castings of the boiler should be pointed when necessary with furnace cement. Examine all control valves, and test the safety valve.



# WANTED: Men to Keep Pace with R.B. Cook

In 1919 R. B. Cook was a book-keeper—holding down a one-track job. In 1923—four years later—he was sales manager of the B. A. Railton Company, Chicago; and ever since that time has successfully directed a sales force of more than seventy salesmen, many of them with twenty years' experience.

"To the casual observer," writes R. A. Railton, General Manager of the B. A. Railton Company, "his rise might seem unusually rapid, but we view it as the natural result of his being prepared for the big opportunity when it came."



When a young man can advance in four years from a routine job to the position of Sales Manager of one of the big wholesale houses of Chicago—without any pull except his own initiative—there must be a reason. There is a reason. It's summed up in the LaSalle salary-doubling plan. What that plan has done for R. B. Cook it can do for any man sincerely ambitious to increase his earnings.

## CHICAGO



## Advance, by this Plan, to Bigger Pay!

Here is the story of a pace-maker—a man who refused to let handicaps obstruct his progress—a man who acts and makes money by this simple principle: *to capitalize his every resource.*

Handicapped by ill health—which kept him in a hospital during four years of his boyhood—R. B. Cook, a Chicago man, bridged the gap in his education by day and evening study, which gave him a sound foundation for LaSalle home-study business training.

Starting as a book-keeper, in 1919, he enrolled for LaSalle training in Modern Business Correspondence and Practice.

"Before I was half way thru my training," writes Mr. Cook, "I was promoted to Collection Manager, with an increase of 50 per cent in salary. Later I became Credit Manager of another concern. This move was a very decided promotion."

"My next advancement was to the position of Office Manager. In each of these positions I was successful. This fact paved the way to my present position. Two years ago I was offered a post as Assistant Credit Manager with my present concern. Within two years I was made General Sales Manager, which position I now hold."

Five years of *consistent progress*—that is the record of Mr. Cook, who has recently enrolled for LaSalle training in Business Management.

Paragraph by paragraph, line by line, he takes up each assignment, asking himself how he can turn each business principle into profit for his company. A single idea—as he writes—which he got from his very first assignment—resulted in savings of many thousands of dollars for his firm.

### Send for Salary-Doubling Plan

You are eager for success. You wish to enjoy the rewards which come inevitably to the man who fits himself for responsibility.

But before you can reap those rewards, you must make yourself more profitable to the business which employs you. By no other method can you possibly succeed.

Cook's experience clearly shows the way—a way illuminated by the careers of thousands of LaSalle-trained men. During only six months' time, for example, as many as 1,248 LaSalle members reported definite salary-increases totaling \$1,322,507, an average increase per man of 89 per cent.

The details of the LaSalle *salary-doubling plan* will be sent you for the asking. Whether you adopt the plan or not, the basic information it will place in your hands, without cost, is of very real and definite value.

Balance the two minutes that it takes to fill out the coupon against the rewards of a successful career—then clip and mail the coupon NOW.

### "Worth More Than \$10,000"

(—So writes R. B. Cook, the employee.)

"The advancement I have made during the past five years to my present position as Sales Manager of the B. A. Railton Company was made possible thru your splendid training and the various services which I have used with much profit. Two years ago I wrote you saying that I would not part with the knowledge LaSalle training has brought me for \$10,000. Today I can say that I would not part with it for several times that amount."

(Signed) R. B. COOK, Chicago.

### "You Are Rendering Our Organization a Distinct Service"

(—So writes R. A. Railton, the employer.)

"In training a half million men, your institution has made a valuable contribution to business. You have added millions to the wealth of the annual earnings of your student members. Their increased productive capacity in turn is adding many millions to the business of the institutions which they serve. I feel that in bringing to our attention a man with the training and capabilities of Mr. Cook, you are rendering our organization a distinct service."

(Signed) R. A. RAILTON, Chicago.

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The World's Largest Business Training Institution

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I shall be glad to have details of your salary-doubling plan, together with complete information regarding the opportunities in the business field I have checked below. Also a copy of "Ten Years Promotion in One," all without obligation.

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- ☐ Modern Salesmanship: Training for position as Sales Executive, Salesman, Sales Coach or Trainer, Sales Promotion Manager, Manufacturer's Agent, Solicitor and all positions in retail, wholesale or specialty selling.
- ☐ Higher Accountancy: Training for position as Auditor, Comptroller, Certified Public Accountant, Cost Accountant, etc.
- ☐ Expert Bookkeeping: Training for position as Head Bookkeeper.
- ☐ C. P. A. Coaching for Advanced Accountants.

- ☐ Law: Training for Bar, LL.B. Degree.
- ☐ Commercial Law: Reading, Reference and Communication Service for Business Men.
- ☐ Traffic Management - Foreign and Domestic: Training for position as Railroads or Inland Traffic Manager, Rate Expert, Freight Solicitor, etc.
- ☐ Railway Station Management: Training for position of Station Accountant, Cashier and Agent, Division Agent, etc.
- ☐ Banking and Finance: Training for executive positions in Banks and Financial Institutions.

- ☐ Industrial Management: Training for positions in Works Management, Production Control, Industrial Engineering, etc.
- ☐ Modern Foremanship and Production Methods: Training for positions in Shop Management, such as that of Supervisor, General Foreman, Foreman, Sub-Foreman, etc.
- ☐ Personnel and Employment Management: Training in the position of Personnel Manager, Industrial Relations Manager, Employment Manager and positions relating to Employee Service.

- ☐ Modern Business Correspondence and Practice: Training for position as Sales or Collection Correspondent, Sales Promotion Manager, Mail Sales Manager, Secretary, etc.
- ☐ Business English: Training for Business Correspondence and Copy Writers.
- ☐ Commercial Spanish: Training for position as Foreign Correspondent with Spanish speaking employees.
- ☐ Effective Speaking: Training in the art of forceful, effective speech for Ministers, Salesmen, Fraternal Leaders, Politicians, Clubmen, etc.



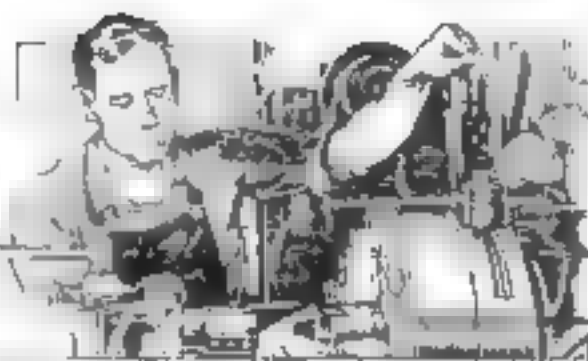
Present Position

Address



# Better Shop Methods

*How Expert Mechanics Save Time and Labor*



By Charles Kugler

**S**UGGESTIONS for punch and die making as outlined in this article are the result of the writer's 30 years' experience as a mechanic. Some of the kinks, so far as the author knows, have not been published before.

In the first part the methods described can be used only in shops that have the proper equipment for this class of work. In the latter part the methods are those useful in shops where the equipment is inadequate or obsolete.

The rules to be given are not broad. The author has in mind an average mechanic and an average job. If your shop has a die-filing machine and a vertical shaper, as well as other good tools, and you have to make a punch and die for such a part as the steel stamping  $\frac{1}{8}$  in. thick, represented by the templet shown in Fig. 1, you can proceed as follows, bearing in mind that this example has been chosen because it allows so many points to be illustrated clearly and not because it represents an economical design from a production standpoint:

**F**IRST, plane or machine the punch, die, stripper, punch pad, and shoe. Grind one side of the punch pad and blue it.

If one has not already been provided, make the templet (Fig. 1) and scribe its outline carefully on the blue surface of the punch pad (Fig. 3). Then assemble the four parts as in Fig. 2. Two  $\frac{1}{8}$ -in. parallels should be placed as shown between the die and shoe for clearance when boring the 1-deg. taper hole in the die. Carefully drill

## Punch and Die Making

*Secrets of Success in a Type of Work Machinists now Encounter Frequently*

and ream dwell-pin holes and drive dwell pins in tight.

The work now is ready to be strapped on the faceplate of a lathe for boring out the four 1-in. holes, as shown in Fig. 4. Carefully indicate the center punch mark and drill and bore one hole; then remove the punch pad and stripper and make the hole in the die taper  $\frac{1}{2}$  deg. on a side. Assemble again and proceed similarly with the other three holes. I remove the punch pad and stripper by prying them apart with a thin chisel without removing the dwell pins or disturbing the setting of the work, but other mechanics provide setscrew holes for forcing them off, which lessens any likelihood of the work's being damaged.

Remove the work from the lathe and, after applying a solution of sulphate of copper or blue vitriol on each of the parts, carefully scribe the outline of the templet on them.

The filing machine (Fig. 5) is used to saw out the core, leaving about  $\frac{1}{32}$  in. for machining.

Now that the core has been removed from the punch pad, stripper, die, and shoe, assemble these parts again as in Fig. 6 and clamp them on the table of the vertical shaper. Carefully line up the outline on the stripper with the ways of the machine and shape the stock until you have split the line. If this is done properly you need not touch the work at all with a file.

Remove the punch pad and stripper, tilt the ram of the machine  $\frac{1}{2}$  deg., and proceed to shape the die for clearance. The writer shapes through the die and shoe in this operation, since the opening in the shoe must be a trifle larger.

Drill the hole in the die for the stop pin, as shown in Fig. 8. The die now is ready to be hardened.

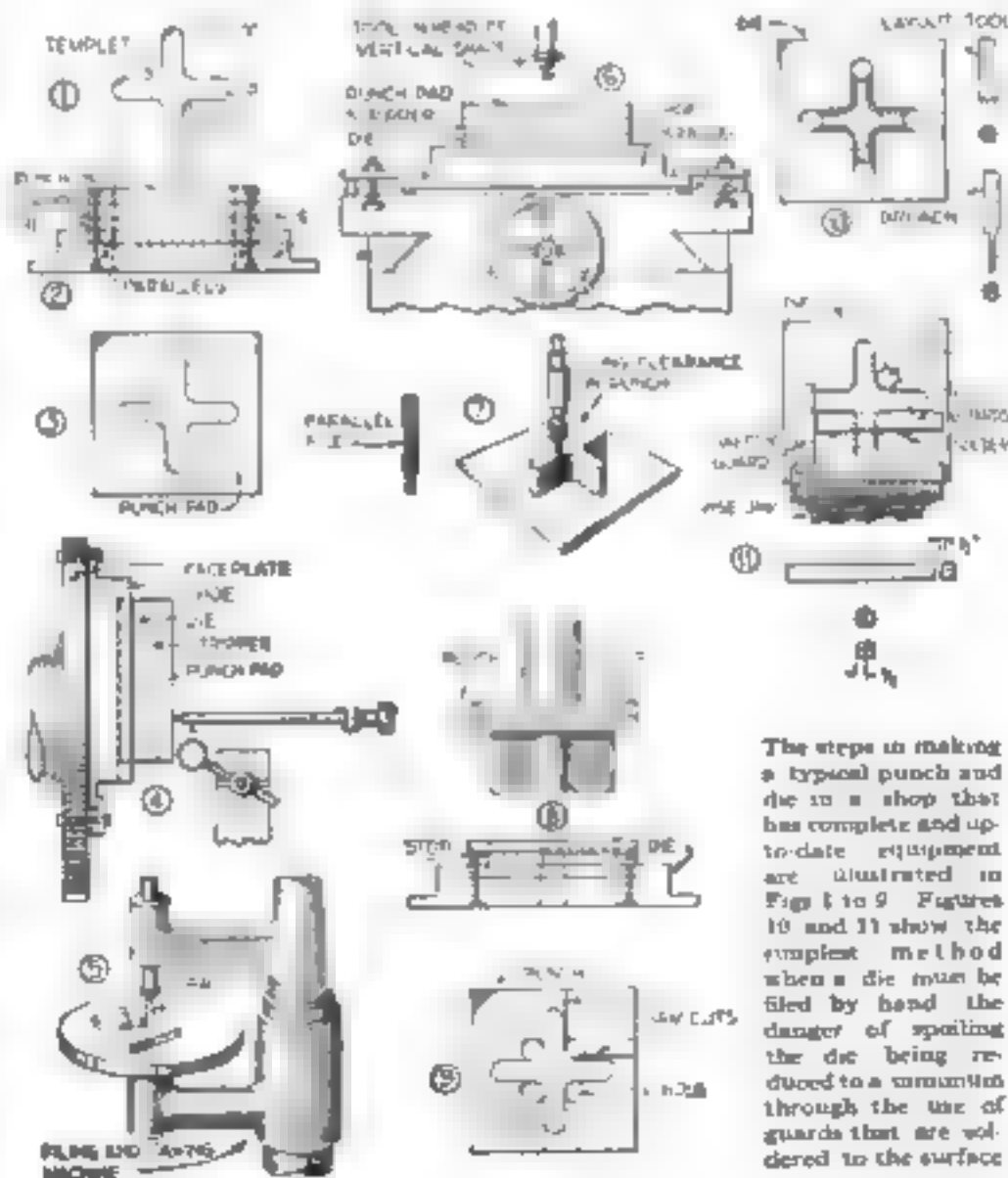
If the steel can be hardened in oil, and a gas furnace and pyrometer are available there is little danger in the hardening process. If the steel must be hardened in water, however, care must be exercised. Heat the steel slowly and, in the absence of a pyrometer, place a few pieces of the same steel in the furnace for use in testing. When you think you have the proper heat, quench one of these pieces and test with a file. In any case, see that all the holes in the die not to be used for cutting metal are plugged up with clay or asbestos.

AFTER the die is hardened, it should be polished on the top and the temper drawn to about straw color. This can be done in the furnace or on a hot plate. If an oil tempering-tank is at hand, it is only necessary to heat the oil to about 450° F. and leave the die in the oil until it attains this temperature. In this case no polishing is necessary.

Grind the die on the top and bottom. The side of the die that is rounded should be ground last; otherwise rocking may cause difficulty.

(Continued on page 140)

**M**ANY time-saving shop ideas are contained in the continuation of the Better Shop Methods Department, which you will find on pages 135 to 145.



The steps in making a typical punch and die in a shop that has complete and up-to-date equipment are illustrated in Figs. 1 to 9. Figures 10 and 11 show the simplest method when a die must be filed by hand, the danger of spoiling the die being reduced to a minimum through the use of guards that are soldered to the surface.



**Starrett**

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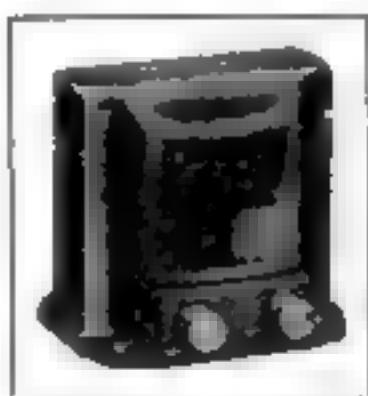


*after all . . . .*

**"HOW WELL YOU CAN HEAR"**  
is the only thing that really counts



**F**OR a few weeks after we get a new radio set we all have the "logged 57 varieties of stations last night" feeling in our blood. Then we get tired and want to sit back and have some real entertainment. For, after all, "How well you can hear" is the only thing that really counts—no matter whether the entertainment is coming from a local station or one a thousand miles away.



*Acme M A-3 Audio Frequency Transformer—more amplification without distortion.*

*"How well you can hear"*

IN THIS "how well you can hear" proposition is where quality comes in—and so does Acme. The

Acme Apparatus Company, pioneer radio and transformer engineers and manufacturers, have long made both transmitting and receiving apparatus of only the highest efficiency. Specialists in amplification, even before the days of broadcasting, this company has perfected "amplification without distortion."

*Make this test with your set*  
**DISTORTION** does not mean merely squeals and

howls. *Any thing which fails to give you an exact reproduction of the human voice is distortion.* Here is how you can test your own set. Start your radio and at the same time keep up a conversation with two or three friends.

Unless you can understand the voice over the radio as easily as that of a friend several feet from you, and without any more concentration and effort than is ordinarily required in talking with him, then you have distortion.

The reason you have to concentrate when listening to a voice speaking over the ordinary radio (an action unnecessary in ordinary conversation) is simply this, the individuality of the voice is lost because distortion has blurred out the overtones which give this vitality and individuality. Monotones are always hard to understand.

The whole story of distortion and how it can be overcome is carefully and fully explained in "Amplification without Distortion," a book on radio reception which is invaluable because it is written by a famous radio engineer in language even the radio novice can completely understand. Over two hundred thousand radio enthusiasts can vouch for the service it will give you. Thousands have written us their thanks. The 9th edition is just off the press. Send for your copy.

*Claude F. Cairns*

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*President, Acme Apparatus Co.*

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20c

7 in.  
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8 in.  
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## The Home Workshop

### How to Use a Coping-Saw Marking and Cutting Fretwork

By Emanuel E. Ericson, *Noted Manual-Training Authority*



1 A coping saw is used for cutting toy parts from thin wood, for making fretwork and overlays for furniture, for fitting moldings together, and for many similar purposes. The simplest type of coping saw is shown above. The blade is inserted so that the teeth cut when the saw is pulled downward.

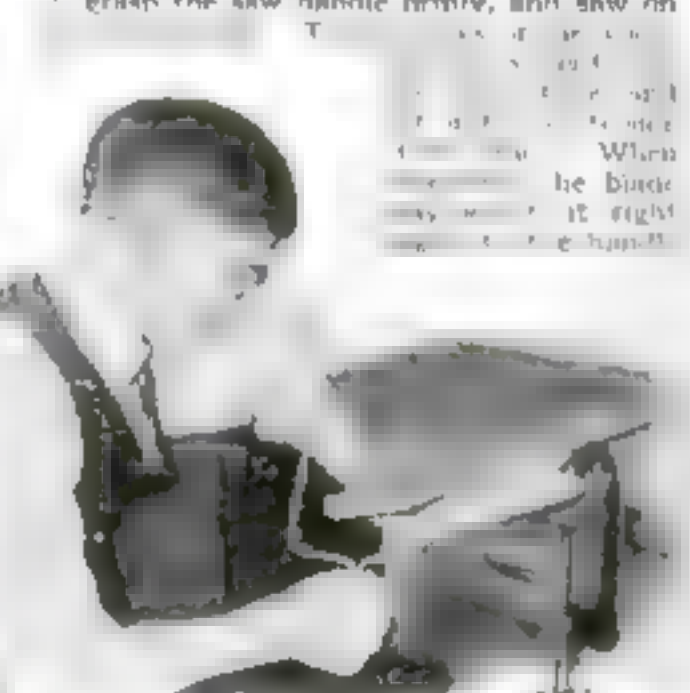


2 To transfer a pattern on the wood or other material, place a sheet of carbon paper face down between the drawing and the stock, and fasten with thumb-tacks or nails, so that there will be no danger of the pattern's shifting. Trace the outline very carefully with a sharp, hard pencil or any pointed instrument.

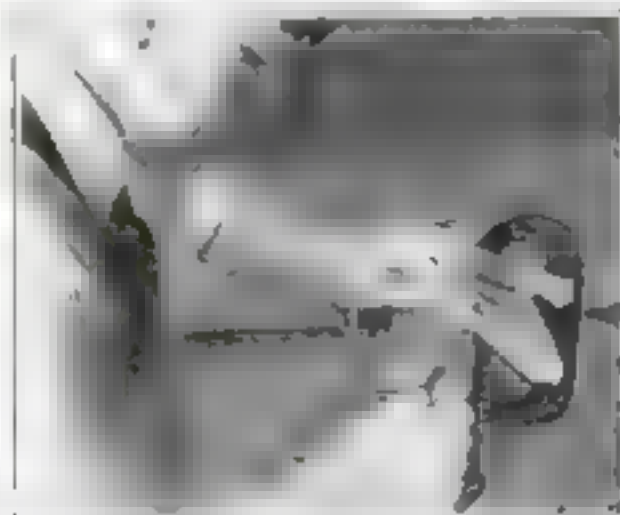
4 Below Lay the wood on the "saddle," grasp the saw handle firmly, and saw on.



3 The wood is held on the "saddle" by the thumb-tacks or nails. When the blade is cut, it will follow the line of the pattern.



5 When an inside cut is to be made, a hole is drilled so that the blade can be inserted in it before being fastened in the frame. For cutting fretwork of large area, use a bracket saw frame, as it is much deeper from blade to back.



6 Moldings are "coped" to join each other at a right angle by cutting a miter at the end of one piece and sawing through the line where the miter and the face of the molding intersect. The abutting molding is not cut at all.



*Whether you smile or cuss  
depends upon the service  
behind your Radio~*

**WHAT** is this radio service which we claim is so necessary?

Do you drive a car?

Do you ever have little things go wrong with it?

You have become so used to minor troubles that you don't condemn the car on which they occasionally occur.

No—

You go right to a service man—a man who knows your make of car. You don't go to a handy man who claims he can fix any car.

That's automobile service, and is one of the main reasons for the auto being the success it is today.

The same service condition exists in radio—the only difference being that people don't yet understand it.

The radio instrument which never requires service has never been built—it never will be.

Like automobile manufacturers, the better radio manufacturers do all within their power to make their instruments mechanically perfect. Nevertheless, like the auto, little things will sometimes go wrong—they are serious to the radio owner but very simple to a factory trained service man.

The handy man who can fix any radio simply experiments until he locates the trouble—such a method was disastrous to the auto in former days—it is disastrous and expensive in radio today. It is not sound.

Ozarka instruments are sold only by Ozarka factory representatives, men who are factory trained in sales and service, men who sell no other radios but Ozarka.

These men don't pretend to know all about radio but they do know all there is to know about Ozarka—isn't that the kind of radio service you want?

Ozarka instruments are sold under a very definite plan. An Ozarka representative will gladly set up an Ozarka in your home—he won't tune it—he won't tell you what it will do—you must operate yourself. If the results you receive by your own operating won't convince you that the Ozarka gives you the distance, volume, selectivity, tone and ease of tuning that you demand then don't buy it.

Ozarka instruments are built to sell themselves but no Ozarka is sold without factory-trained service behind it.

## Openings for a Few More OZARKA Factory Representatives

**O**ZARKA Incorporated, is now entering its 4th year. From a beginning with one engineer, one stenographer, one salesman—our present president, the Ozarka organization has grown to over 3,100 people. There must be some good reason for this growth.

Ozarka instruments have made good—they have more than met competition. Ozarka representatives have made good not only because Ozarka instruments were right but because they have been willing to learn what Ozarka engineers were willing and capable to teach them. Ozarka unusual salesmanship and Ozarka service.

There are still openings for the right man in this organization—men who believe in the future of radio—men who are tired of working for some one else—men who want a business of their own. Prove yourself by sales and willingness to learn and exclusive territory will be given you. The man we want has lived in his community for some time. He has the respect of his fellow men because he has never "put anything over" just to make money. He may not have much money, but he is not broke and is, at least, able to purchase one demonstrating instrument.

## Send for FREE Book

Radio offers a wonderful opportunity to men who are willing to start at the bottom and build. You need not know salesmanship, but will you learn what we will gladly teach you? You may not know radio, but we can and will teach you if you will do your part. With such knowledge and willingness to work it doesn't seem possible that you cannot make good. Sign the coupon below, don't fail to give the name of your county. Better still write a letter, tell us about yourself and attach the coupon. If interested in our salesman's plan ask for "Ozarka Plan No. 100."

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You'll Know the Man  
Behind This Button!

# INCORPORATED

128 Austin Avenue R  
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Gentlemen: Without obligation send book "Ozarka Instruments No. 200" and name of Ozarka representative.

Name \_\_\_\_\_ JO-25-170R  
Address \_\_\_\_\_ City \_\_\_\_\_  
County \_\_\_\_\_ State \_\_\_\_\_

Gentlemen: I am greatly interested in the FREE book "The Ozarka Plan" whereby I can sell your radio instruments.

Name \_\_\_\_\_ TO-25-170R  
Address \_\_\_\_\_ City \_\_\_\_\_  
County \_\_\_\_\_ State \_\_\_\_\_



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No moving parts, and no noise.

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South Bend, Indiana



## The Home Workshop

### How to Perform the Mystifying Thimble-Handkerchief Trick

By Kenneth B. Murray

**P**USHING a thimble through a handkerchief is a neat, simple, and inexpensive little illusion that can be mastered quickly by any one interested in parlor magic. It never fails to astonish those who are not in the secret.

You show your audience an unprepared thimble and a small black handkerchief. Then you place the thimble on a finger of the left hand and cover it with the handkerchief. The next instant you appear to push and pull the thimble violently halfway through the handkerchief. After the audience has been duly impressed, you

pull it all the way through, immediately giving the undamaged handkerchief and the thimble to the spectators for examination.

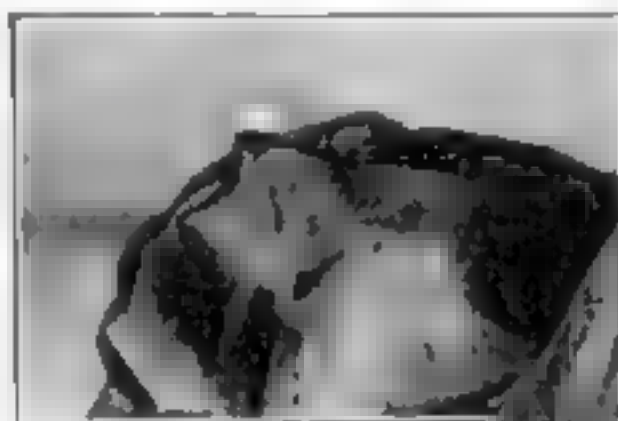
How the trick is done is shown in the photographs below. Practice this illusion 15 times and you will be able to fool almost any one. The method is entirely different from that commonly used, which requires a thimble previously cut in two, and has the advantage that the hand pulling the thimble through the handkerchief can be shown entirely empty, as there is no half-thimble to be concealed.



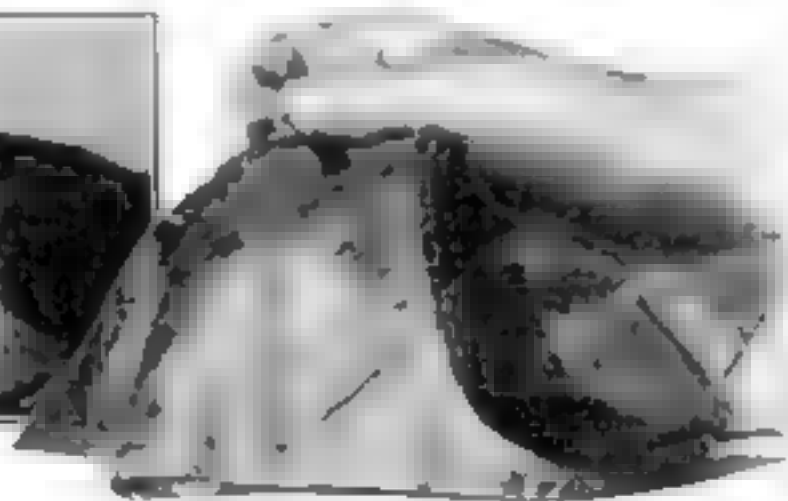
Purchase two thimbles and paint the lower part of one of them halfway around, using any good non-gloss, moisture-proof paint, black in color.



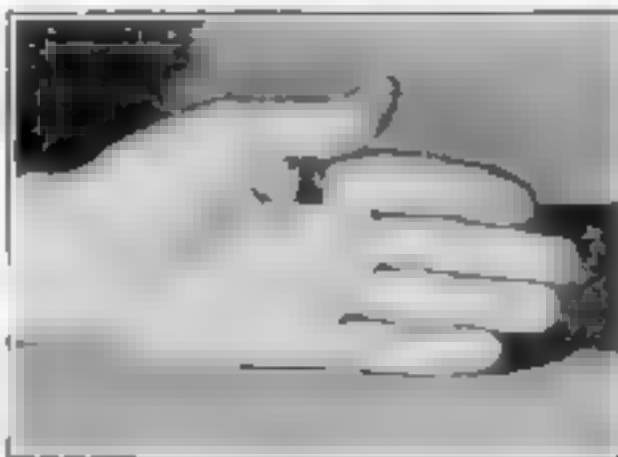
Show the unprepared thimble and a small black handkerchief to the audience. Then place the thimble on the forefinger of your left hand and cover it with the handkerchief. Have the prepared thimble concealed in the right hand.



Place right hand over forefinger of first thimble, which shows through the handkerchief, and push the prepared thimble on it. At a short distance it will seem as if the thimble is sticking halfway through the handkerchief.



At the right: "How to palm or conceal a thimble." It is held lightly at the root of the thumb.

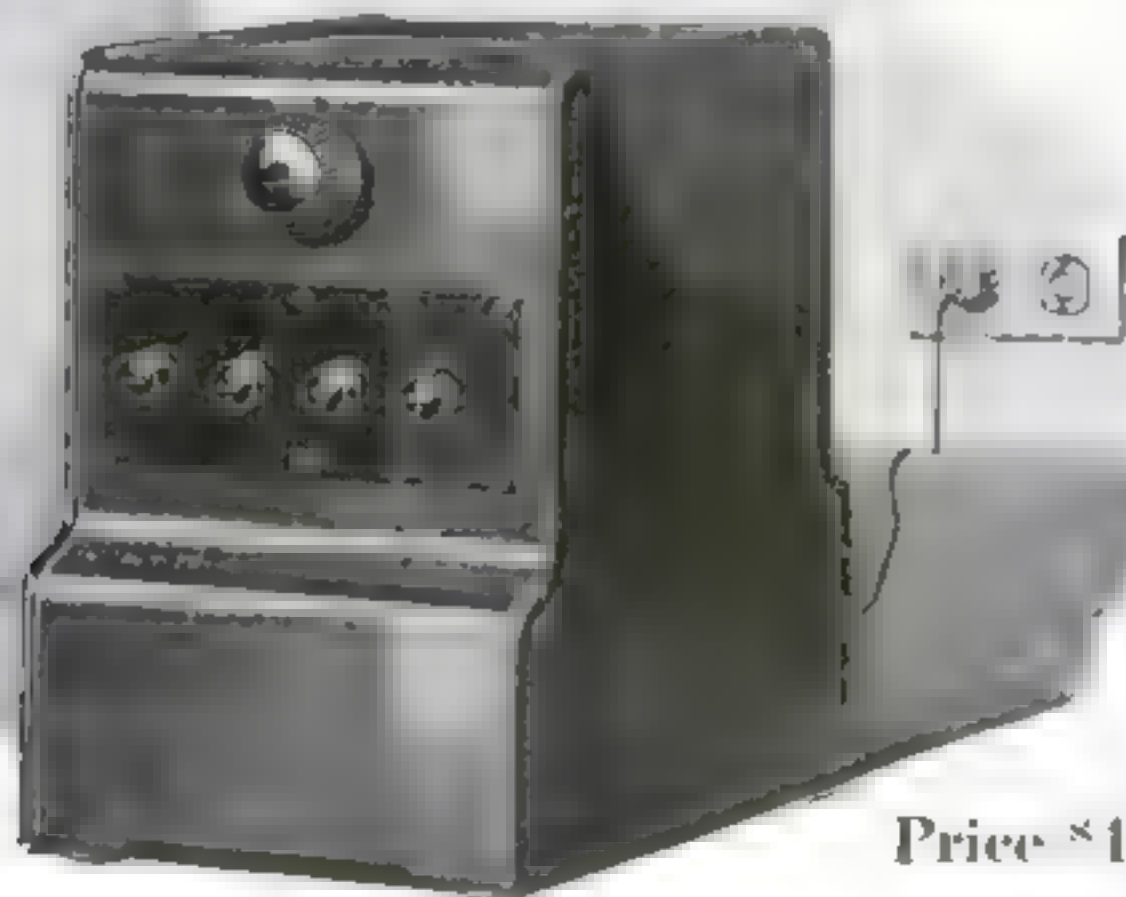


Give spectators time to appreciate the feat and then pretend to pull the thimble entirely through the handkerchief by giving the prepared thimble a half turn so that painted part is at the back, as you remove it. Finally offer the plain thimble and the handkerchief for examination.

**N**EXT in Mr. Murray's series of parlor magic classics is an article on how to make a new type of handker-

chief-vanishing apparatus. If you wish any special trick explained, the Editor will be glad to hear from you.

# Super-Ducon



Price \$17.50

## *Perfected with specially designed* **RCA Tube**

**T**HE Super-Ducon replaces the "B" Battery, operates from the light socket (110 to 115 volts, 60 cycle A.C.) and is absolutely noiseless when properly installed.

Every radio man knows the results he gets when his "B" battery is at its best. The Super-Ducon gives him this top-notch volume *all* the time.

As now furnished, the Super-Ducon has a specially designed R C A tube—Rectron U.V. 196, which has an average life of more than 1,000 hours.

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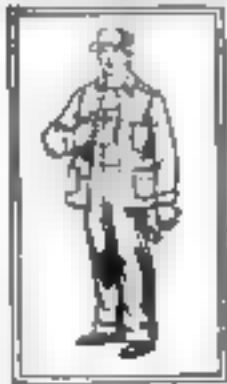
Wear Lee Union-alls, the original one-piece work suit, worn by thousands of mechanics, shopmen, garage workers and industrial workers. Lee Union-alls are quality-built—close-woven cotton fabric, riveted rustproof buttons, reinforced strain points—fully guaranteed to give satisfaction. They give solid comfort, long wear, and are neat in appearance. Accept no substitute—look for Lee on the buttons. Thousands of live dealers sell Lee Union-alls. Ask your dealer today!

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Lee Overalls and Work Shirts are other items in the famous Lee line. They are quality-built, also.

## The Home Workshop

### Simple Cigar-Box Whittling

*Pocket-Knife Is Only Tool Needed to Carve Attractive Patterns in Thin Wood*

By Herbert I. Childs

THREE cigar boxes and a little spare time is the recipe for the ornamental box illustrated below.

It can be used for holding cigars or cigarettes, trinkets and odds and ends or, if lined with plush, as a jewel casket. There are, indeed, so many uses for it that you can be sure you will find it serviceable and, of course, it will make a most acceptable Christmas present.

It is much easier to make than the photograph might suggest at first glance. The basis is a cigar box. Whether you will need to take the original box apart, scrape the paper off, sandpaper it and reassemble the pieces will depend upon what kind of a cigar box you have obtained and whether or not you intend to line the interior.

The ornamentation is built up in layers, each one cut  $\frac{1}{4}$  in. smaller in size than the one below it. For example, if the original cover of the box is 6 by 8 in., the next section will be 5  $\frac{1}{4}$  by 7  $\frac{1}{2}$  in., the next, 5 by 7 in., and so on, until you have obtained the thickness you desire.

With a ruler divide each edge of each section with lines  $\frac{1}{4}$  in. apart. Then between each of the marks cut a V-shaped notch with your pocket-knife. These notches should extend in from the edge  $\frac{1}{2}$  in. so as to bring the points of the notches to a line where they will meet the edge of the section above.

Your initials carved on the top section will look well, or the initials of the one



perhaps, for you to touch them up with fine sandpaper.

The sections are glued in place either with hot cabinet glue or a good grade of liquid glue, and a few fine brads can be used where they will not show, if care is taken not to split the wood.

Work of this kind does not require a highly polished, glossy finish. You may stain the wood, if it is not dark enough to suit your fancy, and either give it one or two coats of very thin shellac, or one coat of thin shellac and one coat of flat drying varnish or furniture wax, or merely a coat of genuine linseed oil and turpentine mixed half and half and applied warm.

There are five important points to observe in all whittling. Close your hand about your knife with the thumb over the fingers, as if to reinforce them—a good firm grip and yet not so tight as to cramp your hand. Always cut with the full length of the blade, if possible, drawing it from the heel to the point. Do not let your knife get dull. As soon as it begins to draw hard, sharpen it by the method described in my article last month. Always whittle away from you, if you can; you will cut faster, as well as insure yourself against accident. Do not use your knife as a screwdriver, a can-opener, or a hammer; countless good knives are spoiled through such misuse.

Put a drop of oil now and then on the spring end with the blades three-quarters closed. Dry joints are harmful to the knife in time and in many cases are a source of annoyance to the user because the blades will not close entirely.



An ordinary cigar box decorated with the simplest variety of pocket-knife carving.

to whom you intend to give the box, if it is to be a present. Mark them carefully and cut away the surface so as to give a raised effect to the letters. There is no special rule to go by, in fact, one of the fascinating things about whittling is that you can do everything to suit your own taste.

As a rule, carving should not be sandpapered, as it is desirable to have the tool marks show to some extent; but if you have left any rough places, it will be well

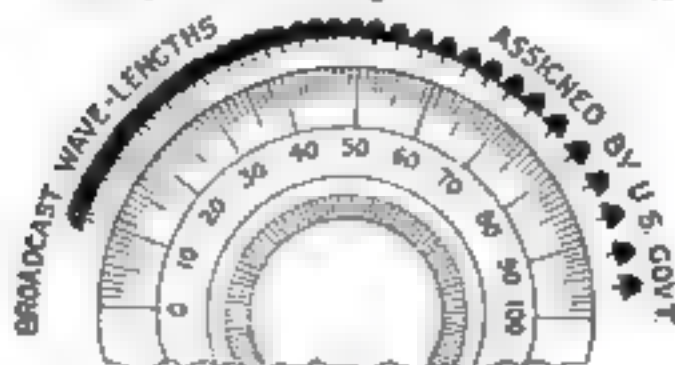
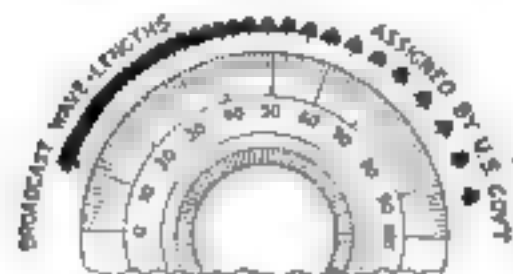
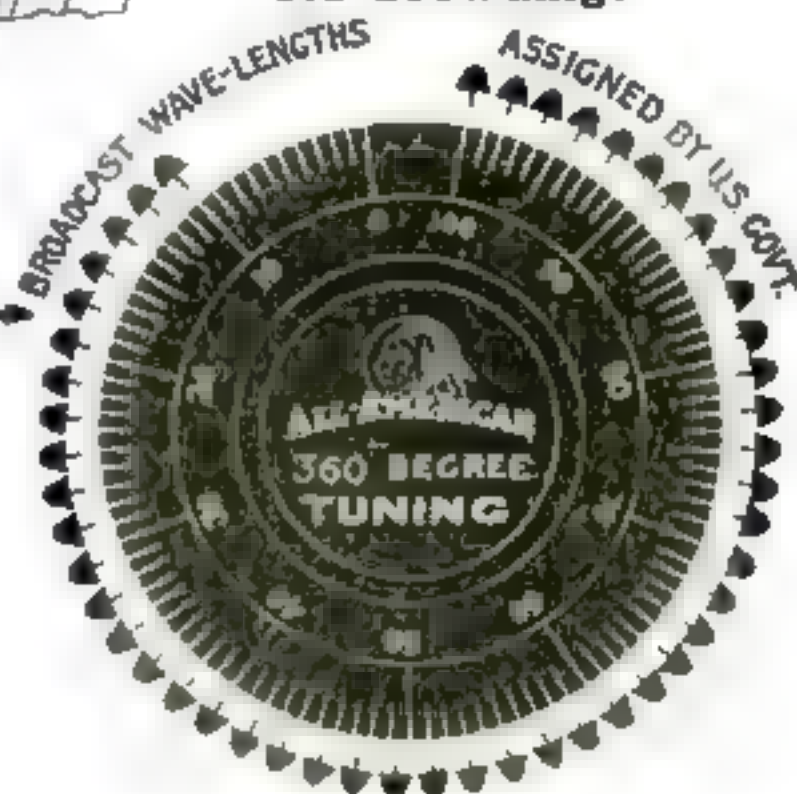
TWO especially noteworthy articles for amateur mechanics are on the schedule for next month. One tells in detail how to use glue to the best advantage in the home workshop. The other is on fitting and hanging storm sash quickly and accurately.

This Year—

Better, But Crowding Still Troublesome

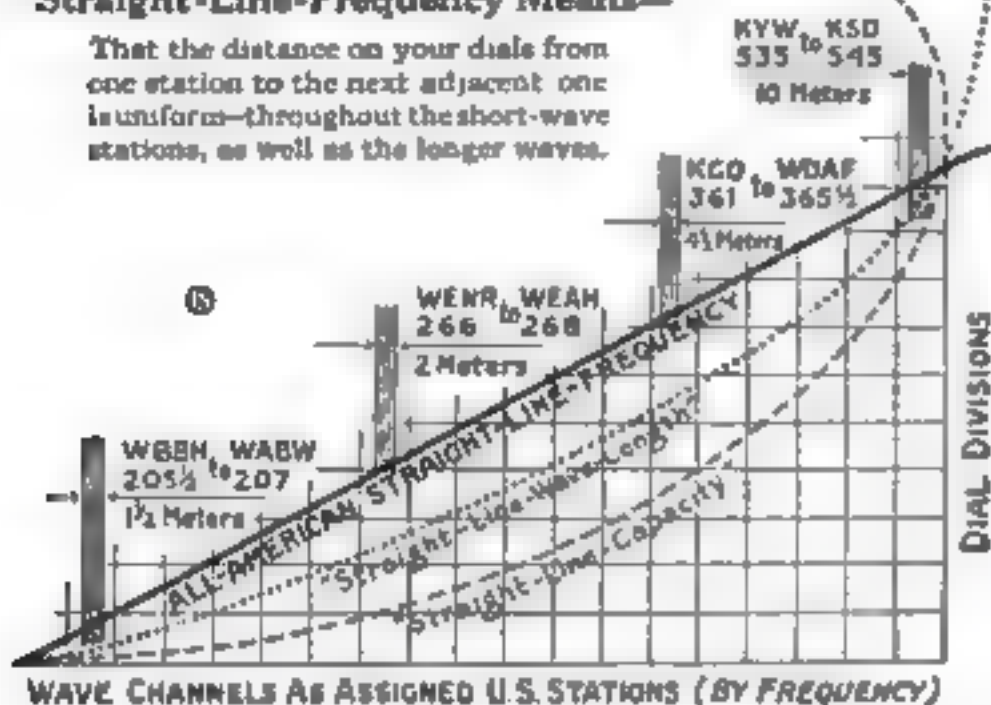
Last Year—

Bad Crowding of Shorter-Wave Stations

Next Year—  
No Crowding!

Straight-Line-Frequency Means—

That the distance on your dial from one station to the next adjacent one is uniform—throughout the short-wave stations, as well as the longer waves.



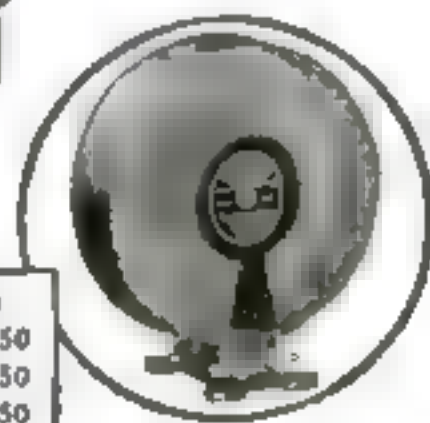
WAVE CHANNELS AS ASSIGNED U.S. STATIONS (BY FREQUENCY)

50-KILOCYCLE INTERVALS ARE SHOWN  
ALTERNATE CHANNELS OMITTED  
FOR CLEARNESS

# ALL-AMERICAN STRAIGHT-LINE-FREQUENCY TUNING



**All-American Straight-Line-Frequency Condensers**  
Type C-35 Max. 350 micromicrofarads (Min. 10.5 mmf) . . . \$4.50  
Type C-50 Max. 500 micromicrofarads (Min. 11.8 mmf) . . . \$5.00



**All-American Toroid Coils**  
Type T-1 Antenna Coupler \$3.50  
Type T-2 R.F. Transformer 3.50  
Set of 3 Coils complete . . . \$10.50

Ease and certainty in tuning—no more crowding of short-wave stations—no need to buy vernier dials—no gears or other back-lash makers—body capacity absolutely not distinguishable—electrical efficiency unsurpassed—on one-half the panel space: that is the All-American Straight-Line-Frequency Condensers.

New power for distance reception through close coupling—tuning of arrow-like sharpness—elimination of all oscillation worries through the self-enclosed endless magnetic field—non-radiating reception: that is All-American Toroid Coils—Antenna Coupler and Radio Frequency Transformers. See them at your dealer's.

A new edition of the famous RADIO KEY BOOK, together with complete information about the new ALL-AMERICAN Straight-Line-Frequency TUNING, is yours for 10 cents, coin or stamps. Send for it today sure!

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OWNING AND OPERATING STATION WENR—266 METERS

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*Pioneers in the Radio Industry*





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## Dwarf in size Giant in service

"Yankee" Hand Drill No. 1530 is the biggest, little tool you can own.

Only 10 1/4 in. long. You can carry it in your pocket. Weighs but 1 1/4 pounds. Yet it has all the famous ratchet adjustments of the big "Yankee" Hand Drills and Breast Drills.

### "YANKEE" Ratchet Hand Drill No. 1530

Works in places impossible for other drills, by means of five ratchet adjustments, controlled by just a finger touch on the ratchet shifter.

3-jaw chuck holds round drills up to 3/16 in.

#### Some other "Yankee" Tools

Ratchet Bit Brace      Ratchet Screw Drivers  
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Dealers everywhere sell "Yankee" Tools

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NORTH BROS. MFG. CO., Philadelphia, U. S. A.

# "YANKEE" TOOLS

Make Better Mechanics

## The Home Workshop

### Striking-Bag Mounted to Give Realistic Boxing Practice

WHILE it is unlike anything that can be found in sporting-goods stores, the method of mounting a striking-bag shown in the accompanying illustrations has advantages that immediately will be apparent to every athlete.

The ball rebounds at various angles from the slanting rafters and boards, so the boxer is afforded an opportunity to block, duck, side-step, and back-step, approximating actual boxing movements, instead of going through the usual monotonous drumming exercises.

The idea had its origin in improving a striking-bag mounting in an attic, as in Fig. 1. The only materials needed for such a mounting are six boards. They are placed between the rafters to prevent the bag's being penetrated by any shingle nails that stick through the roof.

The sharp corners of the three rafters against which the bag caroms are rounded to a radius of 1/4 in. with a plane.

With rafters pitched at the usual angle there will be about 28 in. of rope between the loop in the bag and the swivel, if the bag is hung at about the height of the stomach, which is to be recommended.

An elaboration of the same idea, designed for a large training or recreation camp, is shown in Fig. 2. It is a four-bag platform. One bag is mounted in the



Fig. 1. Novel method of mounting a striking-bag in an attic. Only six short boards are required.

usual style under a horizontal platform. A heavy sand bag is suspended from one end of the cross piece and a "double-end" is provided at the other end. The fourth bag is mounted as previously described.

Guy wires provided with turnbuckles can be substituted for the upright braces A and B and if a light "exhibition" bag is used under the platform, the triangular braces indicated at C-D will be sufficient.

Figure 3 shows an outdoor or straight wall platform for a single bag. In

case a heavy "gym" bag is used, the back and ends should be boarded up to form a V-shaped trough, which should be filled with sand. The top should be covered with a sloping roof to keep the sand dry. The "two by four" from which the bag is suspended can be braced, if necessary, with triangular blocks screwed in place.—R. L. K.

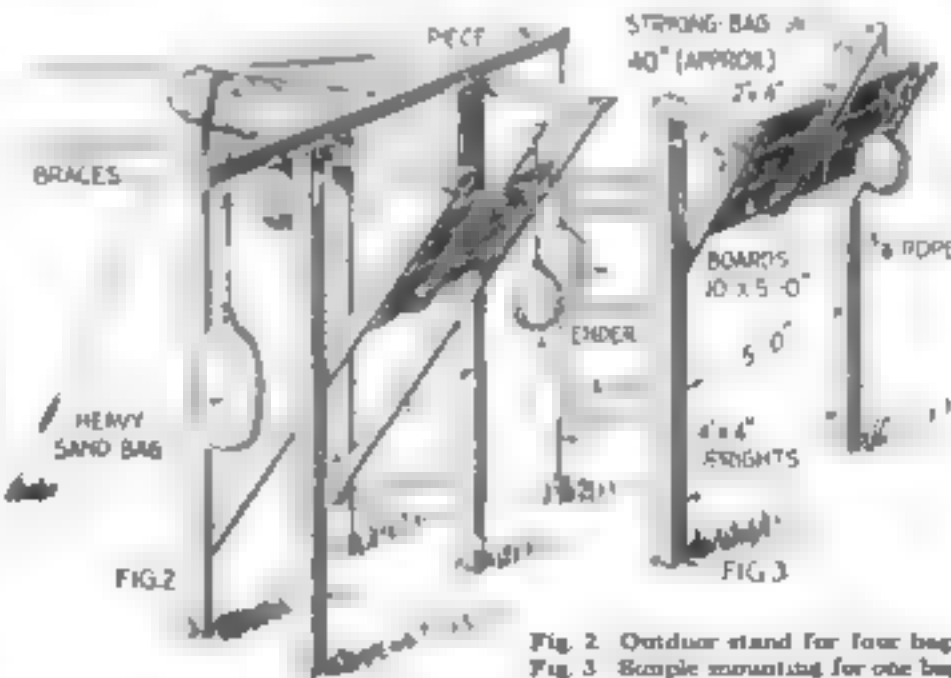


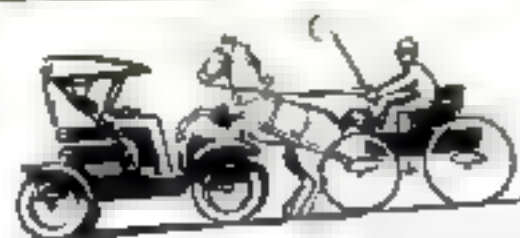
Fig. 2. Outdoor stand for four bags.  
Fig. 3. Simple mounting for one bag.

### Mixing Paint and Whiting to Make Putty

IN PAINTING about the house, small amounts of putty are required at intervals, yet if prepared putty is purchased in pound cans, it becomes hard and unusable in time. I find it is better to mix a little dry whiting with a bit of the paint that is being used. This can be done in a moment's time and the putty

then matches the paint in color. There is no waste, as only a sufficient amount for the job on hand need be mixed.

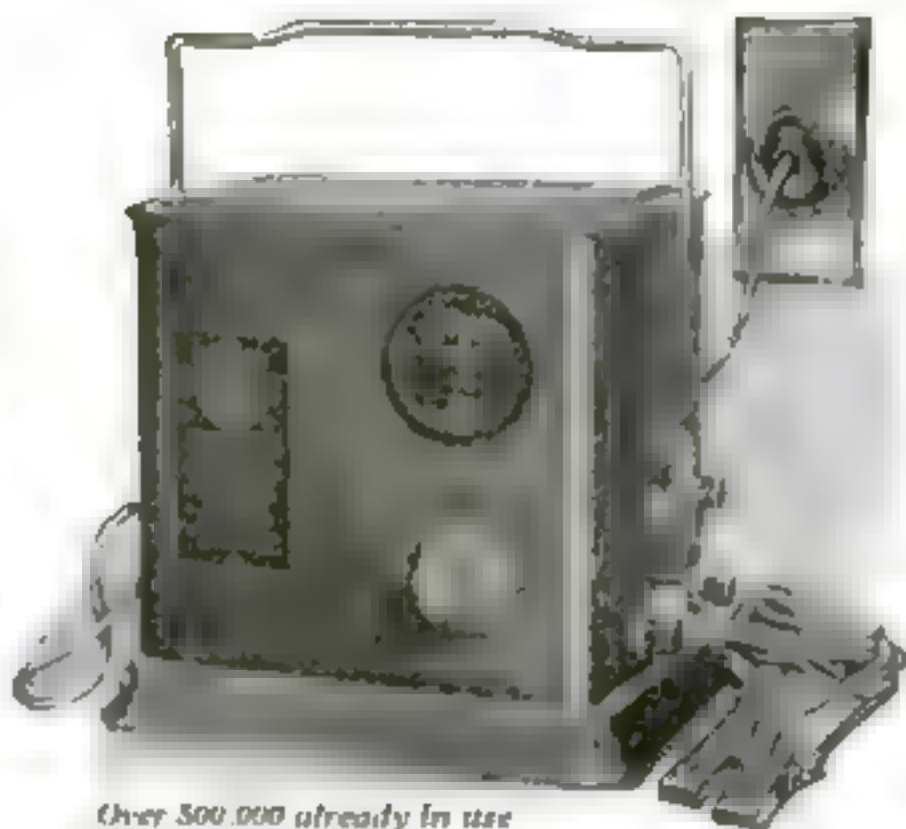
This method is especially desirable when flat-drying interior paints and enamel undercoaters are being used, because ordinary linseed-oil putty should not be used with them.—R. E. CHAPPEL.



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**5 AMP. A & B**  
**GOLD SEAL**  
**HOMCHARGER**  
**\$19<sup>50</sup>**



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**Better Because:—**

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Beautiful cabinet in maroon and gold.

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WD-11, WD-12, UV-199, UV-200, and UV-201-A are the type names of Radiotrons. They belong to Radiotrons only. To be sure you are buying the genuine, look for the name Radiotron and the RCA mark on the base. Then you are sure of quality.

Radio Corporation of America  
Chicago New York San Francisco

# Radiotron

REG. U.S. PAT. OFF.

AN RCA PRODUCT

## Home Workshop

### Blueprints Will Aid You in Making Christmas Presents

WHAT are you planning to make in the way of furniture for Christmas presents? If you have in mind anything elaborate, the sooner you get your materials together, the better.



Bench (15) and Smoking Stand (8)

You will need first of all a trustworthy and carefully detailed working drawing and a complete bill of materials or cutting list, as woodworkers often call it. Just here the Home Workshop Department can be of real assistance to

you, for it offers you a wide range of blueprints listed below—at the nominal price of 25 cents each.

Especially to be recommended for Christmas gifts are the sewing table (No. 1), the smoking cabinet (No. 2), the kitchen cabinet (No. 5), the tea wagon (No. 13), the workbench (No. 15), the cedar and mahogany chest (No. 17), and the radio sets (Nos. 41-43).

### Complete List of Blueprints

ANY one of the blueprints listed below can be obtained from POPULAR SCIENCE MONTHLY for 25 cents. The Editor will be glad to answer any specific questions relative to tools, material, or equipment. Blueprint Service Dept.

Popular Science Monthly  
250 Fourth Avenue, New York

#### GENTLEMEN:

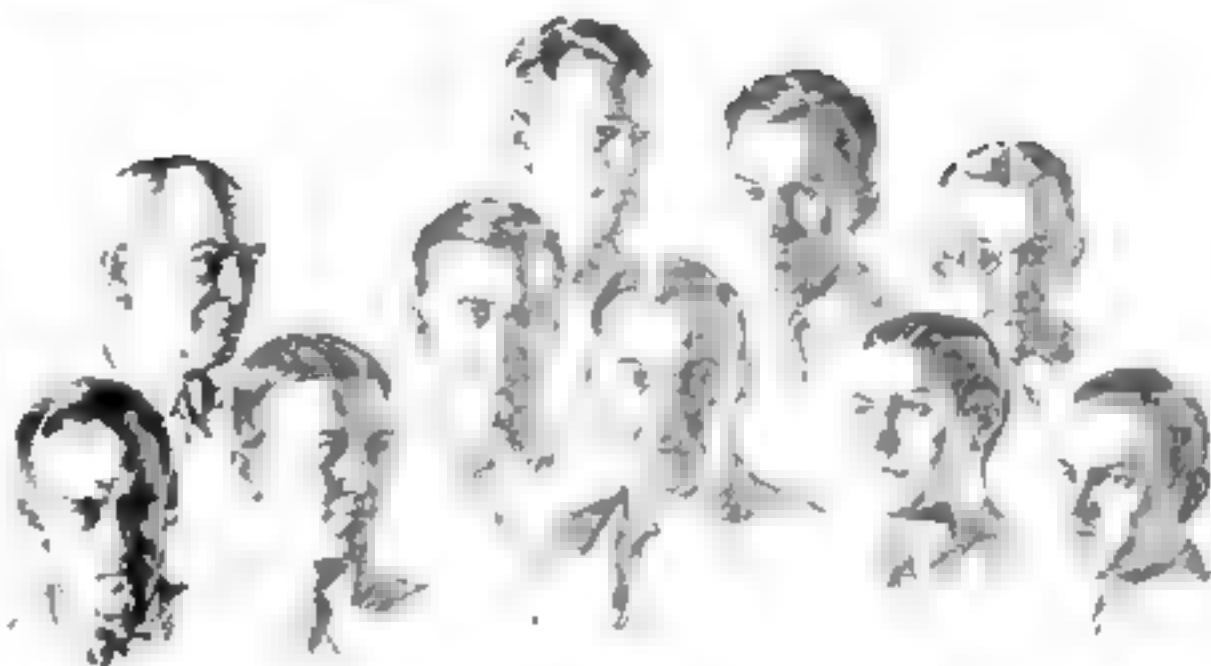
Send me the blueprint, or blueprints, I have underlined below, for which I inclose . . . . . cents:

No.	Title	Published	Price
1	Sewing Table	Feb. '22	25c
2	Smoking Cabinet	Mar. '22	25c
3	End Table	Apr. '22	25c
5	Kitchen Cabinet	May '22	25c
8	Shaving Cabinet	June '22	25c
9	Arboreal Gate and Seats	July '22	25c
10	Porch Swing	Aug. '22	25c
12	Bench and Tilt Table	Sept. '22	25c
12	Electric Washer	Oct. '22	25c
13	Tea Wagon	Nov. '22	25c
14	Christmas Toys	Dec. '22	25c
15	Workshop Bench	Jan. '23	25c
15	Inside Radio Cabinet	Feb. '23	25c
17	Cedar Chest	Mar. '23	25c
18	Phone Table and Stool	Mar. '23	25c
19	Grandfather's Clock	Apr. '23	25c
20	Flat Top Desk	Apr. '23	25c
21	Colonial Desk	Apr. '23	25c
22	Cabinet and Desk	Apr. '23	25c
23	Pergola Garage	May '23	25c
24	Gateleg Table	June '23	25c
25	Canoe Bailing Outfit	July '23	25c
26	Baby's Crib and Pen	Sept. '23	25c
27	Kitchen Cabinet Table	Oct. '23	25c
28	Pullman Play Table	Nov. '23	25c
29	Toy Tea Cart, etc.	Dec. '23	25c
30	Tool Cabinet, etc.	Jan. '24	25c
31	Sewing Cabinets	Feb. '24	25c
32	Chinese Game Table	Mar. '24	25c
33	Dining Alcove	Apr. '24	25c
34	Garden Trellis	May '24	25c
35	Simple Radio Cabinet	Oct. '24	25c
36	Rush Bottom Chair	Nov. '24	25c
37	Simplified Bookcase	Dec. '24	25c
38	Sheraton Table	Jan. '25	25c
39	Salem Chest	Feb. '25	25c
40	Desk in Sheraton Style	Mar. '25	25c
41	One Tube Radio Set	May '25	25c
42	Three Stage Amplifier	June '25	25c
43	Four Tube Receiver	July '25	25c

Name (Please print)

Street

City and State



## We Want Men

with tough, wiry beards to challenge this

Let us send you free a 10-day tube of this unique shaving cream which softens the toughest beard in one minute!

MEN claim that Palmolive Shaving Cream will soften the toughest beard in one minute. No finger rubbing—hot water or cold, hard water or soft.

That's a broad statement, we'll agree.

You may doubt it. But, if true, you want that kind of shaving.

Let us give you a 10-day tube free. Find out for yourself. We believe we'll win you, no matter how firmly you are wedded to a rival preparation.

### NEW Principles

Palmolive Shaving Cream is a new-comer in its field . . . yet, to-day the leader.

Millions of men have quit old ways and adopted this new shaving joy.

Probably 80% of its users were boosters for other makes of cream.

All were won over by the test we now offer you. "Don't buy—yet," we urge you. Put the proof burden on us.

\* \* \*

60 years of soap study stand behind this creation . . . made by the makers of Palmolive Soap.

## PALMOLIVE SHAVING CREAM

1929

130 formulas were discarded before we found the right one.

1000 men told us their supreme desires in a shaving cream. Only by great effort did we meet them.

New principles were required. New laboratory methods and experiments.

Palmolive Shaving Cream thus is different from any other you have known.

### 5 New Delights

These you'll find—these new shaving joys, these comforts unknown before.

- 1 Multiplies itself in lather 250 times.
- 2 Softens the beard in one minute.
- 3 Maintains its creamy fullness for 10 minutes on the face.
- 4 Strong bubbles hold the hairs erect for cutting.
- 5 Fine after-effects, due to palm and olive oil content.

### 10 Shaves Free

Now in fairness to us, and in justice to yourself, clip the coupon before you forget. Find out whether the whole world is wise in changing to a new way in beard softening.



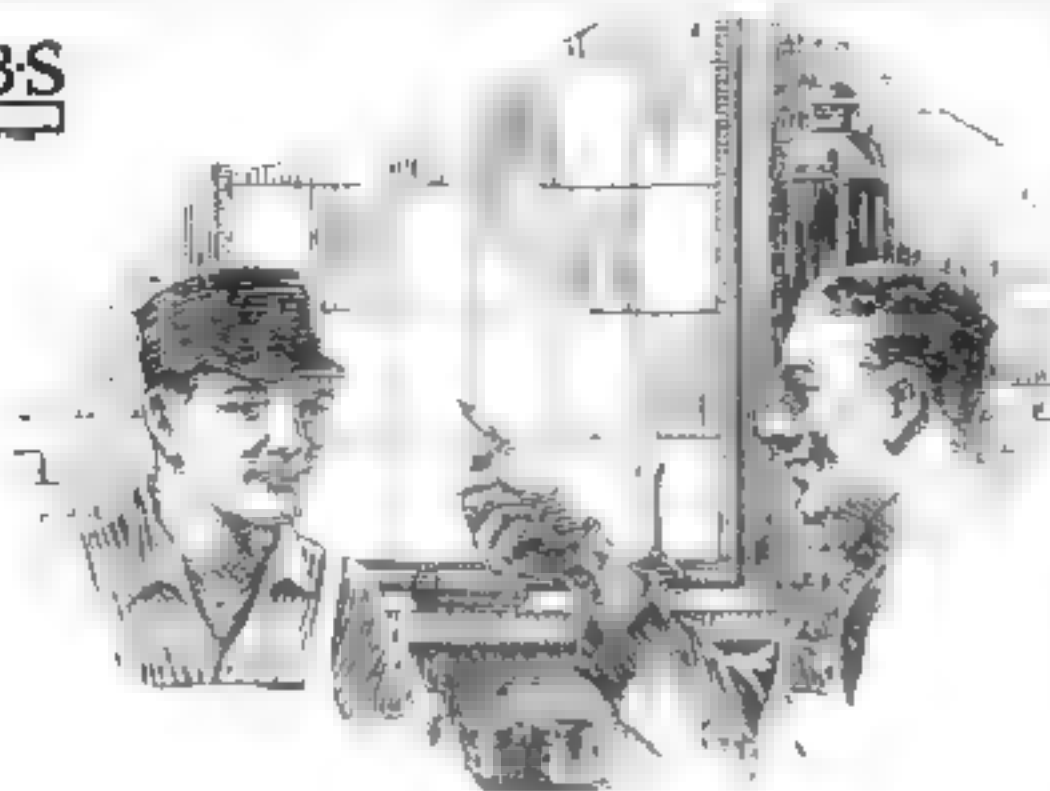
## 10 SHAVES FREE and a can of Palmolive After Shaving Talc

Simply insert your name and address and mail to Dept. B-1072, The Palmolive Company (Del. Corp.), 3742 Iron Street, Chicago, Ill.

Residents of Wisconsin should address the Palmolive Company (Wis. Corp.), Milwaukee, Wis.



B.S.



**"Yes, Jim, that's why I got a better job"**

"In the first place, remember, I have a kit of good tools. While the rest of you boys were shooting pool or at the movies, I was studying and building up my kit with Brown & Sharpe Tools getting ready for a bigger job. Some of the tools I didn't really need then, but I was certainly glad I had them later. When my chance came, I was ready,—that's why I got a better job."

Every mechanic finds that only with the best tools can he do his best work. With a good kit he is qualified to go higher. —He is equipped for the bigger job when it comes. Build up your kit with Brown & Sharpe Tools.

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**BROWN & SHARPE**  
**TOOLS**

**"Standard of the Mechanical World"**

**The Home Workshop**

## How to Reline Auto Clutches

By Ray F. Kune

Principal, Automotive Trades School,  
Cincinnati, Ohio

**E**VEN with the best of care, clutches will wear out and need new linings or facings. A well designed clutch, cared for as suggested last month, will give many seasons of average service without relining. In many instances the clutch facings will not need to be replaced in the life of the car. In other cases the clutch facings will be damaged, seriously worn, or cut out.

The average car, excepting the Ford, has a so-called unit power-plant mounting of the clutch and transmission on the flywheel housing of the engine. The transmission case has a bell housing cast or bolted on it. This housing is machined to fit and be bolted to the flywheel housing. Consequently it is necessary to remove or "drop" the



### Applying Clutch Facings

The rivet head is riveted on a punch held in the vise and a cushion rivet set or a ball-peen hammer is used to form the butt.

transmission whenever repair work is to be undertaken on the clutch.

Individual cars may vary in this respect, however, and there are a number of cars having what is known as an amidship transmission mounting. As in the case of the unit power plant, it will be necessary to release and remove the transmission for any clutch work.

When preparing for the removal of the transmission, first place the car where it will be most convenient. Block the front wheels to prevent it rolling, since the brakes must be disconnected. Remove all brake connections, speedometer connections, and other attachments. There is always a universal attached to the rear of the transmission and from this universal a propeller shaft is run to the rear axle, where there may or may not be another universal, depending on whether or not the propeller shaft is of the type enclosed in a torque tube.

If the torque-tube construction is used, there is only one universal, and in order to drop the transmission it first is neces-

*(Continued on page 90)*

# Kolster's Genius

## Brings a New Thrill in Radio—

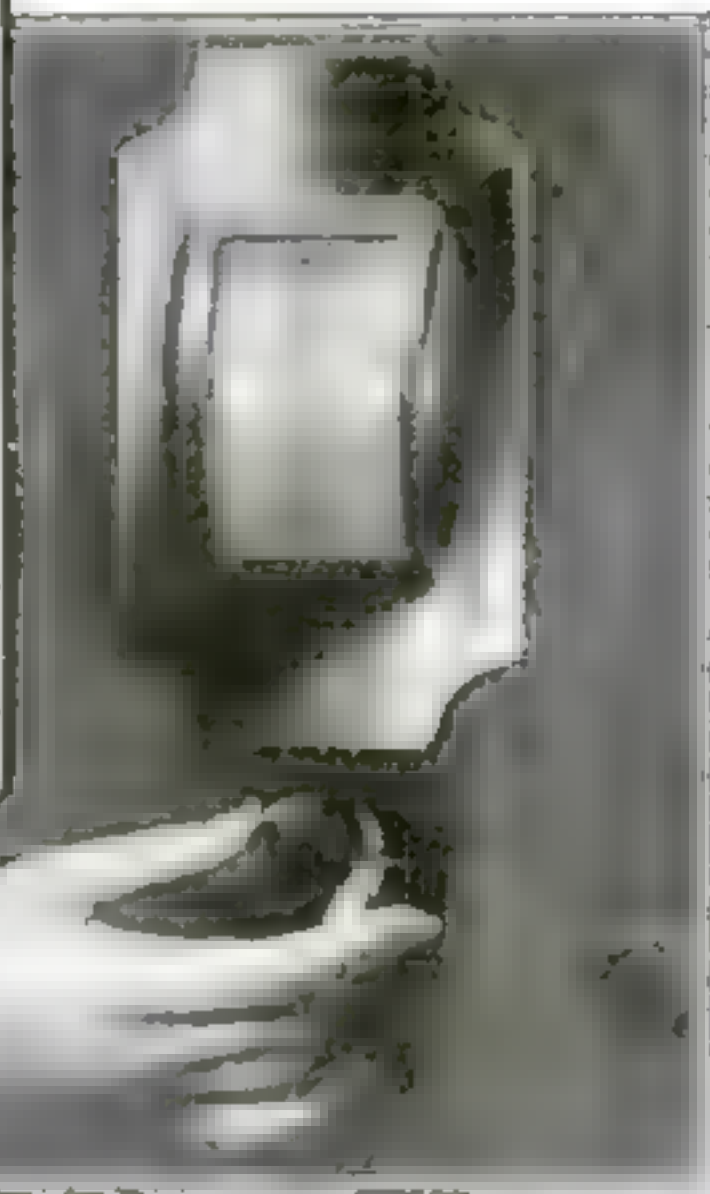


**E. A. KOLSTER**

Eight years he has  
been in the  
National Bureau of  
Standards

and has been  
in charge of the  
radio section since  
1917.

The first scientific  
radio receiver was  
designed by him  
for the Navy  
Department.



Kolsters are presented in four models, one of which is pictured here; two are cabinets, two are for tables.

It was bound to come! This new era in radio.

Some great pioneer staff of radio experts was destined to introduce that most wanted feature in radio: Perfected reproduction.

That honor has fallen to Kolster and his associates.

Now comes a distinct new era in radio—the experimental period of reception is over. Now reproduction is the new-day development.

To hear a Kolster is a revelation of radio's real possibilities.

Never have you heard such reproduction—so startlingly real, so free from interference. New magic!

And all because of certain Kolster refinements. This great genius has found the way to reproduce a broader range of tones.

In all their charm, the subtle overtones—the hitherto "lost chords" are now developed.

Now radio becomes genuinely realistic—not merely mechanical transmission of sound.

## A Surprise, Indeed

Hear this wonder instrument—either at the nearest Kolster dealer or in your own home.

Kolsters are housed in fine cabinets—masterpieces of design and beauty, adding charm and elegance to any room.

Once you hear the Kolster, you'll revise your standards of radio enjoyment—you'll be unhappy with a lesser instrument.

Discriminating people are saying with justifiable pride: "I own a Kolster."

## No Dials!

Super-tone is only one of many Kolster advancements.

*This remarkable instrument has no dials!*

Here is ultimate simplicity you've been expecting.

You just turn from one station to another on a register bearing the names of the different stations.

No "tricky" tuning with numerous dials. A child can operate it—perfectly every time.

A Kolster is to today's radio what today's automobile is to the old "horseless" carriage.

It is extremely powerful—selective and sensitive. All the old-time handicaps are eliminated. No "background" interference, no "howls."



# KOLSTER RADIO



# SPECIAL SAWS OF SPECIAL STEEL



**T**HERE is a Simonds Service Shop or Supply Dealer near you to furnish promptly Simonds quality Circular Saws, Band Saws, Files, and Planer Knives. Write for Mill Saw Catalog.

# SIMONDS

Pronounced SI-MONDS  
**SAWS FILES KNIVES STEEL**  
SIMONDS SAW AND STEEL COMPANY, Fitchburg, Massachusetts  
"The Saw Maker" Branch Stores and Service Shops in Principal Cities Established 1832

## The Home Workshop

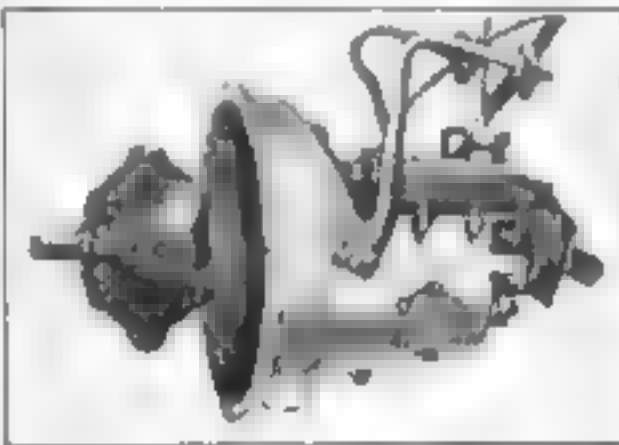
### How to Reline Auto Clutches

*(Continued from page 36)*

sary to loosen all brake rods and then the spring clips holding the springs to the rear axle. When all the items that might prevent the removal of the rear axle are loose, the car frame is jacked up high enough to take all the weight off the rear springs and blocked securely in that position. Next, roll the rear axle back far enough to allow the splined joint of the universal to separate.

Covering the universal in this type of construction is a boot of leather or a steel cover of ball-and-socket type. This will have to be loosened. In other instances the front end of the propeller shaft is carried in a yoke and in that case the yoke pins need to be removed.

When the construction involves the use of an exposed propeller shaft there are always two universals. In this construction the rear axle need not be moved back, but the universals are removed from their flanges by removing the bolts,



Before the clutch can be taken out, the transmission must be removed from the car

and thus the propeller shaft and universals are removed together. Whatever the construction, the transmission cannot be dropped until the propeller shaft is removed.

After the attachments to the transmission are all free, the bell-housing type of transmission is removed by taking out all the small cap screws or bolts used to clamp it to the flywheel housing. Block up under it to prevent its dropping down when the screws are released. If there is a clamp supporting the clutch and brake pedal, it should be loosened.

When all parts are loose, slide the transmission back on its blocking. Note the small ballbearing on the forward end of the clutch shaft or in the flywheel center, which is used to carry the forward end of the clutch shaft and keep it in alignment. This is an important point in reassembling.

Slide the transmission out from under the car and remove the clutch and brake pedals and throw-out mechanism. This will allow the clutch to be removed as a unit in most cases.

Place the clutch under a press or use several blocks and a jack to compress the clutch springs. As a rule, a split washer will be found that may be removed and then the clutch springs released and the plates separated. Note carefully the method of clutch

*(Continued on page 42)*

EVEREADY HOUR  
EVERY TUESDAY AT 8 P. M.

WEAF	5	WSAI	6
WAB	5	WWJ	6
WEEI	5	WCCO	6
WFI	5	WOC	6
WUN	5		
WLAE	5		

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No ONE size or type of battery can be economical on every type of receiving set. That's why Eveready Radio Batteries are made in different sizes and types—so that every radio user can enjoy the economy that is to be had by fitting exactly the right Eveready Battery to his receiver. Even owners of sets with five, six, eight or more tubes, and power amplifiers, can realize Eveready economy to the full by using the new, radically different Eveready *Layerbilt* "B" Battery No. 486. There is an Eveready dealer nearby

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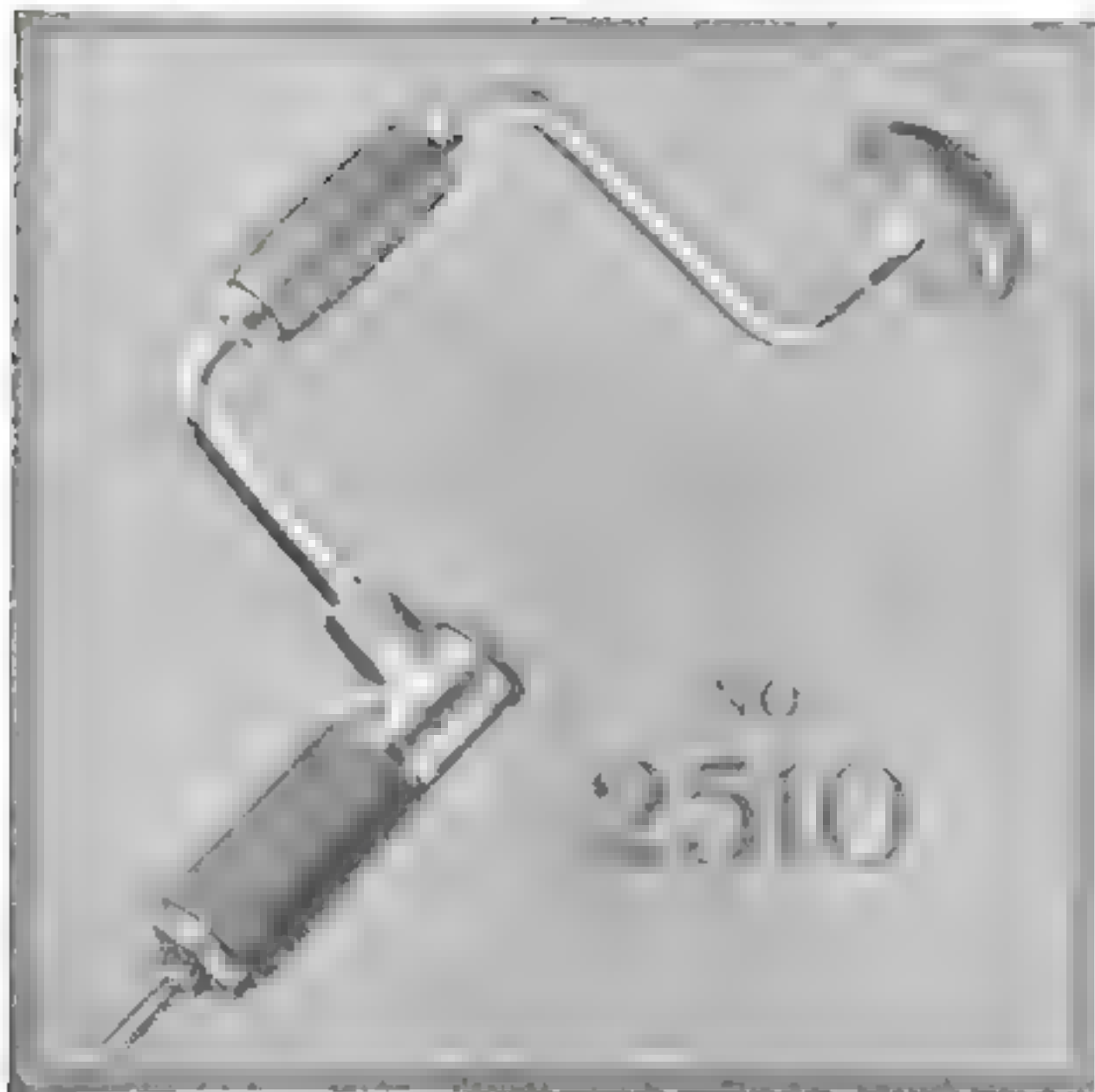
# EVEREADY

## Radio Batteries

*—they last longer*







## Here's the Brace, men that you have dreamed of

**O**PEN up the jaws of that powerful chuck and feed it the biggest, fattest square shank you can find. Try an expansion bit if you have one. See how it slips through without a murmur. Put your hand around that finely knurled hardened steel chuck shell and run it down. How those jaws do grip!

Drop in a Morse Taper shank or a straight round shank, same result; perfect centering and that bulldog grip. Put the hexagon nose of the shell in a wrench or vise if you want a still more positive grip; you cannot hurt this little brute. That goes for the ratchet mechanism too.

Where is the ratchet mechanism? Safely encased in that neat

red enameled drop forging just above the chuck shell. Something entirely new—a patented feature—and this ratchet mechanism is as sure and as husky as it is different. Can you imagine yourself stripping a hardened tool steel dog  $1\frac{1}{4}$  inches long which bites into teeth broached in a forged steel head? Just try to do it!

Need we add that the heavy steel sweep is nicely nickel plated, that the head and handle are polished rosewood, that the steel clad head is set on roller bearings? Only the best of fittings could have a place on a brace like this one. You can't find a better bit brace. Closely priced, too—\$6.20. Good hardware stores sell it.

GOODELL-PRATT COMPANY, GREENFIELD, MASS., U.S.A.

*Toolsmiths*

# GOODELL-PRATT

## 1500 GOOD TOOLS

### Mr. Home Workshop

#### Unique Wooden Vise Is Aid in Keeping Saws Sharp

**T**HE handsaw filing vise or clamp illustrated can be made of scrap lumber to be found in any home workshop and will prove both substantial and convenient. The jaws are 28 in. long, so that

CLAMP 28" LONG



How the saw filing vise is made

the entire saw can be clamped at one setting. When one side is sharpened, the saw and vise are turned bodily to file the other side. The frame is high enough to be placed on the floor and leaned against a bench in the best light. Placing one foot on the lower rail steadies the vise during filing.

Note that the wire is bound around the V-shape notches to prevent the wood from splitting.—W. L.

#### How to Reline Auto Clutches

*Continued from page 91.*

assembly when dismantling

In certain types of construction, notably the single plate, the clutch is assembled within the flywheel and will remain in the flywheel after the transmission has been removed. In this type it will be necessary to remove the plate bolted to the flywheel and thus get at the clutch facings, which as a rule are not fastened to any of the parts.

As a rule, in the multiple-plate or disk type, two friction disks are riveted to a steel plate that turns with the flywheel. When replacing these facings, which may be secured either from the supply houses or the dealer, care must be exercised to see that the rivets used are brass or copper and well countersunk so that there is no chance of their coming into contact with the steel faces of the driving disks. Most clutch facings come from the factory with properly countersunk or counterbored holes. If they have not been provided, however, care must be used in drilling them so as not to get them too deep. Any badly scored unlined clutch disks should be replaced.

When reassembling the clutch plates, use care to have them aligned so that they may be placed on the pins of the flywheel or in the grooves that are provided. It will be necessary to use the press or a jack to put pressure on the spring, or springs, in most cases.

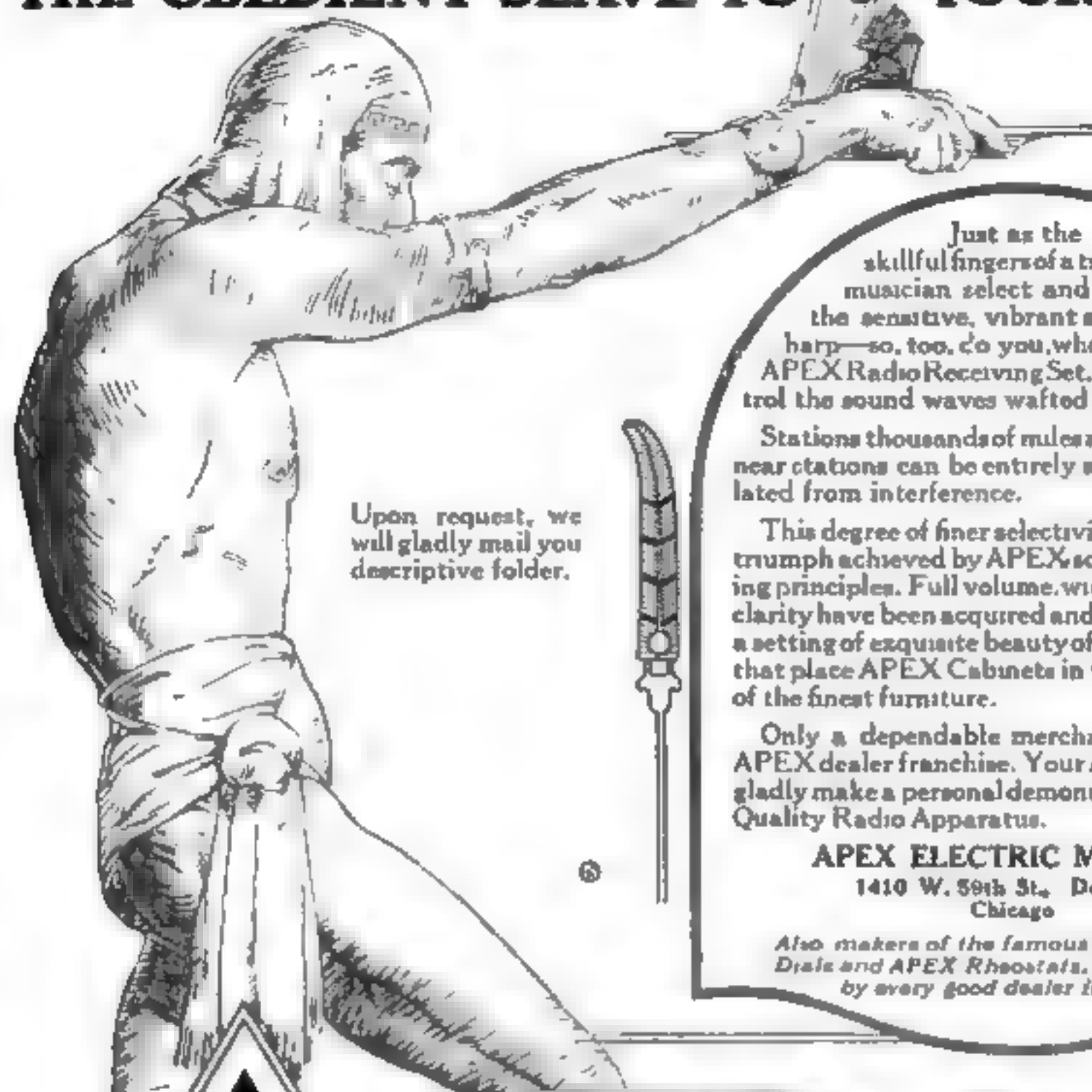
Make all connections that were removed preparatory to the work. It is a good plan to repack the universals with grease, clean and repack the pilot bearing, and properly lubricate all parts needing such attention.

When the job is finally assembled, it may be necessary to readjust the clutch pedal to the floorboard position.

Mr. Kuns' next article will be "What Makes My Car Jump Out of Second Speed?"

# SELECTIVITY

## THE OBEDIENT SLAVE TO YOUR DESIRES



Upon request, we will gladly mail you descriptive folder.

Just as the skillful fingers of a trained musician select and control the sensitive, vibrant strings of a harp—so, too, do you, who operate an APEX Radio Receiving Set, select and control the sound waves wafted through the air.

Stations thousands of miles away, or powerful near stations can be entirely and instantly isolated from interference.

This degree of finer selectivity is not the only triumph achieved by APEX scientific engineering principles. Full volume, wider range, greater clarity have been acquired and are enthroned in a setting of exquisite beauty of design and finish that place APEX Cabinets in the highest ranks of the finest furniture.

Only a dependable merchant is given the APEX dealer franchise. Your APEX dealer will gladly make a personal demonstration of APEX Quality Radio Apparatus.

**APEX ELECTRIC MFG. CO.**

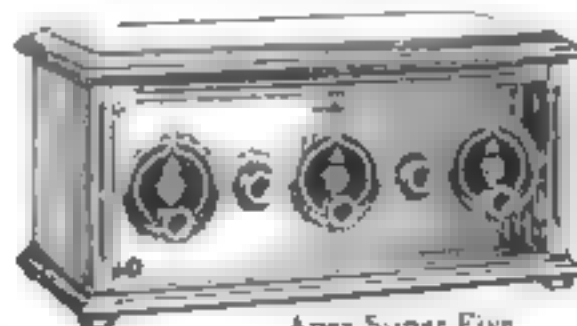
1410 W. 59th St., Dept. 1003  
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*Also makers of the famous APEX Vernier Dials and APEX Rheostats, which are sold by every good dealer in Radio.*

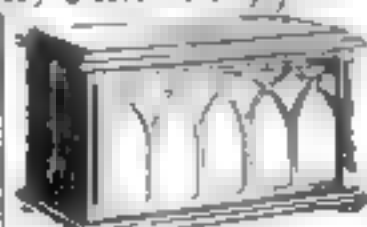
**APEX**  
Quality Radio Apparatus



Apex Baby  
Grand Console  
Price \$225



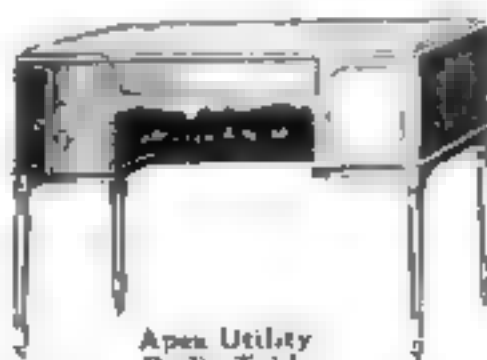
Apex Super Five  
Price \$95  
without accessories



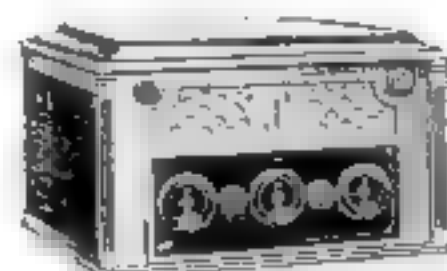
Apex Console  
Entertainer Price \$27.50



Apex  
Entertainer  
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Apex Utility  
Radio Table  
Price \$75



Apex De Luxe  
Price \$135

Prices West of Rockies slightly higher. Canadian prices approximately 40% higher.



When you see a "Hex"—think of BLACKHAWK!

## Work Hounds

**G**OING after hidden nuts and bolts with a set of Blackhawk "Q. D.'s" is like putting bloodhounds on their trail. They like the work, and they never quit!

Have your dealer show you a Blackhawk "Q. D." set designed especially for your own make and model of car—it handles every nut you need ever worry about.

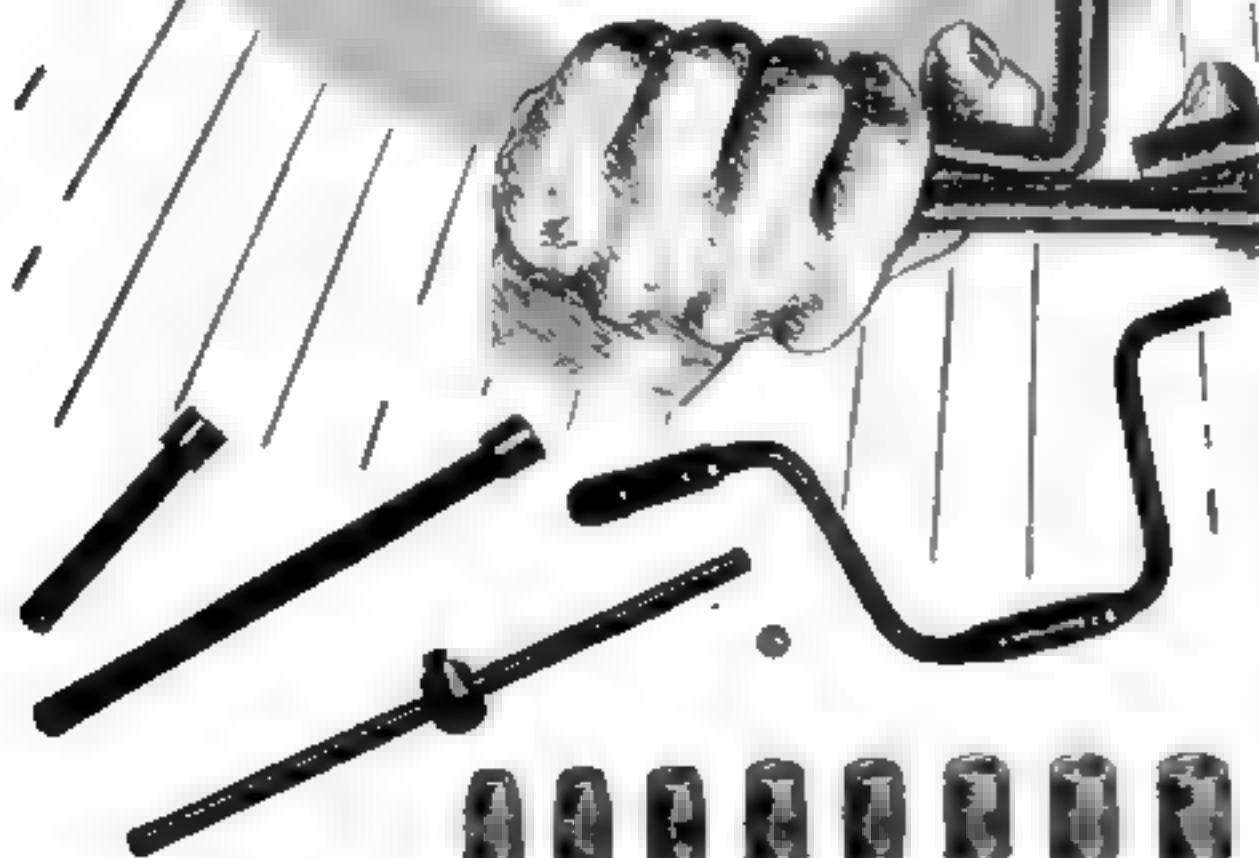
Downright quality is built into every Blackhawk "Q. D." set. Tough steel sockets, balanced handles built for the job, comfortable, hand-fitting grips, and a satiny black finish baked on to stay.

If your dealer is not stocked yet, write us direct.

**BLACKHAWK MFG. COMPANY**

(Formerly Aviation Grinder Mfg. Co.)  
Dept. L Milwaukee, Wis.

Also manufacturers of Blackhawk Water Pumps for Fords.



# BLACKHAWK

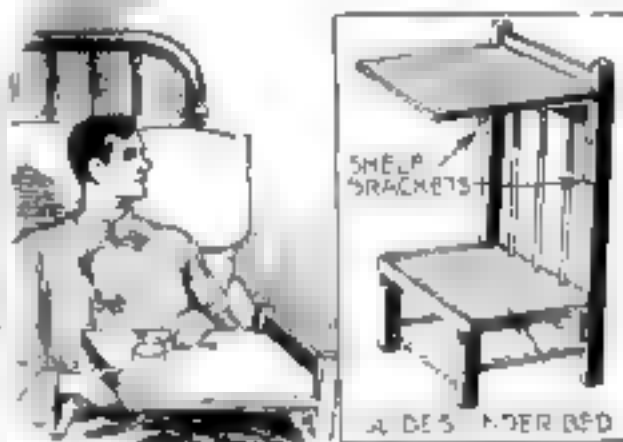
Welded Wrenches

## Home Workshop

### Old Chair Used as Support for Bed Table

**I**N ILLNESS a bed table invariably adds to the patient's comfort and saves work on the part of the nurse, yet rarely is it considered worth while to purchase a special hospital table for home use.

A good substitute can be constructed by sawing off the legs of a discarded chair



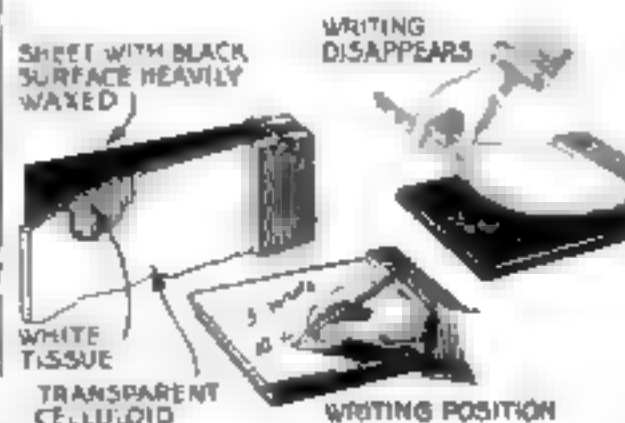
The table board is attached to the back of the chair with heavy shelf brackets.

short enough so that the seat will slip under the edge of the bed. To the back of the chair fasten with shelf brackets a board the size of the seat in such a position that when the chair seat is slipped under the bed the table extends in front of the patient.—MINNIE BRITT RIGGLE, Bavaria, Kan.

### Writing Is Erased Instantly from Everlasting Pad

**H**AVE you a place in your office or workshop for a scratch pad that is everlasting and indestructible? One may be made by coating a 1/16-in. thick sheet of black fiber or composition with paraffin. A sheet of aluminum will do nicely if it is given a heavy coat of dull black paint before being waxed.

A sheet of tough, yet very thin tissue paper and a sheet of thin celluloid, such as

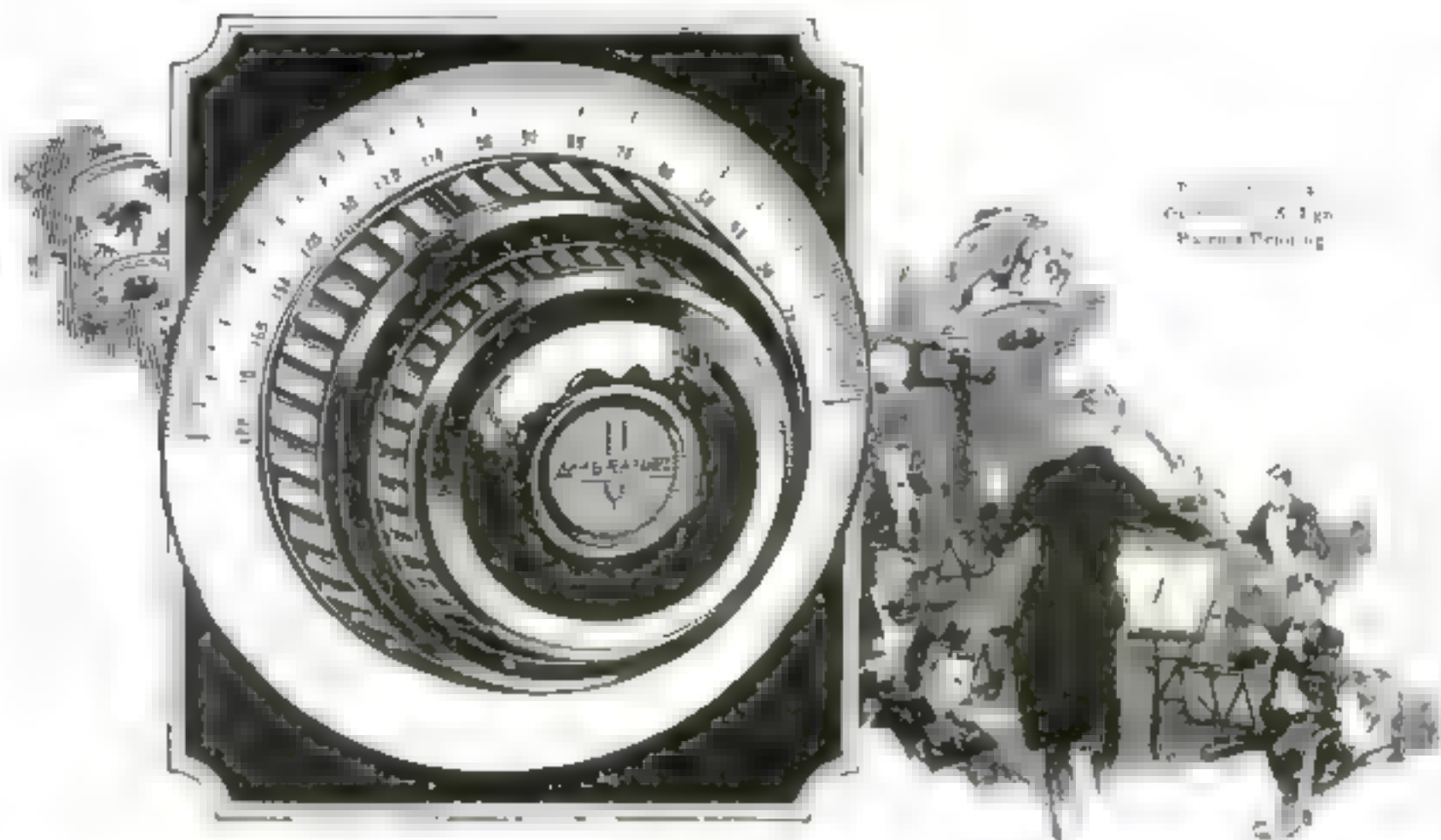


Notes made on the celluloid surface vanish when the celluloid and tissue paper are raised.

is used in auto curtains, are cut the same width as the black base, but about 1/2 in. longer. The illustration clearly shows how the three sheets are assembled. The paper and celluloid are glued together along the edge farthest from the binding.

To write, use a pencil or any stylus, such as a nail or match. To erase the writing, merely lift the projecting edge of the celluloid sheet.—A. E. WILLIAMSON, Cleveland, Ohio.

## AN ESSENTIAL ACCESSORY



*When accuracy tuning counts—*

## ACCURATUNE



WHEN there's a particularly fine program at one of the stations within the scope of your set, then if ever do you yearn for precision, and that's exactly what you can be assured of if your set is equipped with the Accuratune.

Geared on an 80-to-1 ratio for coarse or infinitely fine tuning, the Accuratune performs with uncanny precision at all times. Moreover, it's easily substituted for ordinary dials without altering your set.

MYDAR RADIO COMPANY  
15 CAMPBELL ST., NEWARK, N. J.





# 58 Stations in One Evening

## Improved Radio Frequency Amplification

One of the leading features that place the TORODYNE ahead of the field is the use of Toroidal Transformers, which give it:

1. **GREATER SELECTIVITY** due to the fact that these coils do not pick up outside interference. Only the signal to which the set is tuned can be picked up as it must come through the antenna. Toroidal transformers will not pick up signals themselves.

2. **MORE VOLUME** without oscillations. These coils permit this by minimizing interstage coupling.

3. **DISTANCE.** The greater amplification increases the sensitivity bringing in distant stations with more volume. This naturally increases the range of the set.

4. **SUPERIOR TONE QUALITY** is secured through the elimination of distortion and foreign noise by preventing stray feed-backs.

IN ONE EVENING (two and one half hours actual time) 58 stations from Los Angeles to Boston, Calgary, Alberta to Ft. Worth and from Ottawa to Miami, Florida, were received with good volume and equal clarity of tone through a loud speaker. The time includes waiting for the announcement of call letters. Local Broadcasting was going on at the time without interfering.

This is but one of the records of the TORODYNE, the latest AINSWORTH Receiver. It is a five-tube, tuned radio frequency receiver with Torodial (doughnut type) transformers, which greatly increase the scope of radio frequency amplification. The TORODYNE will bear comparison favorably with any set and the difference can be quickly and easily distinguished.

An attractive, silver engraved sub panel leaves only the condensers and tube sockets visible on the inside of the cabinet. All terminals are mounted on this panel and plainly marked to insure correct connections. The entire construction is simple, compact and efficient. The TORODYNE is easy to tune and its accuracy permits constant logging.

The refined beauty of the TORODYNE harmonizes with any period furniture. The black, sloping panel is silver engraved by a patented process and mounted in an Adam brown mahogany cabinet. Pointers on Bakelite knobs over scales engraved on the panel.

In every way the TORODYNE is a set you will be proud to display to your friends—beauty, exceptional performance and the latest improvements in radio.

The TORODYNE will give genuine satisfaction. Ask your dealer for a demonstration and judge for yourself. (If your dealer is not showing the TORODYNE, write us.)

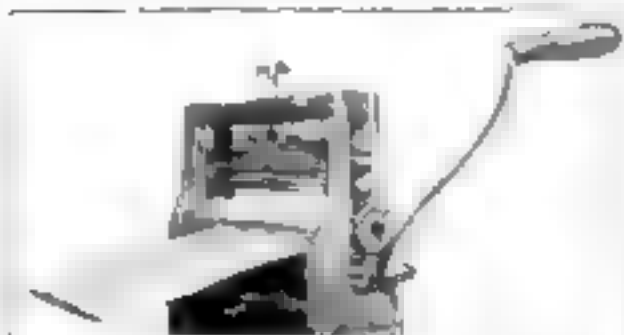
Price \$100.00

**The Ainsworth Radio Company**

Third & Main Streets

Cincinnati, Ohio

### Ferrotyped Photos Squeegeed in Old Clothes-Wringer



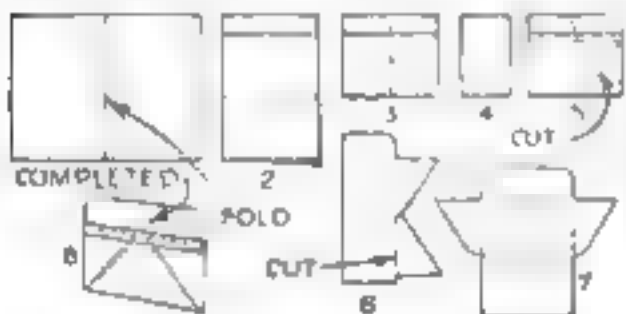
THE amateur photographer, who makes very glossy prints by ferrotyping on a Japan tinned metal plate, often finds the rolling of the prints by hand tiresome. When many prints are to be made, an old clothes-wringer is useful.

The best results are obtained by placing the wet prints face down on the plate and then putting one blotter over the prints and another underneath the plate. Only moderate pressure is necessary.

### Unique Method for Cutting and Folding Neat Envelopes

CHEAP and easily obtained as are envelopes, it probably has happened again and again that you have not had an envelope at hand of exactly the right size or quality to suit some special purpose. This predicament will never cause any delay, however, if you know the trick of making a square-cornered envelope with nothing but paper and scissors.

Any paper can be used. Good quality letter or sample paper may be used for small envelopes, and drawing, manila, or



Eight steps in making large or small envelopes without the aid of ruler or square

heavy wrapping paper for large ones.

The sheet, say an 8½ by 11 in. letter-head, is first folded from left to right on the vertical center line. Next, it is folded from the bottom up (2) to bring the bottom edge within 1 in. of the top edge. Next fold in the center (3) to get a crease for cutting (4). Open out and cut the outline of the flaps (5), as shown by the heavy dotted lines. This is easily done without drawing guide lines. Open the sheet at the lower fold (6) and cut off the superfluous flaps to give the completed form (7). The envelope then is folded (8). The small retaining flap, when folded over, holds the envelope in shape while the letter is being inserted.

Paste is applied to the top flap when the envelope is used, or it may be applied and left to dry, as on commercial envelopes. Pasting down the top flap seals the entire envelope, although the side flaps also can be pasted if desired.—J. A. FITZPATRICK, Milesburg, Pa.

# TRADE YALE MARK

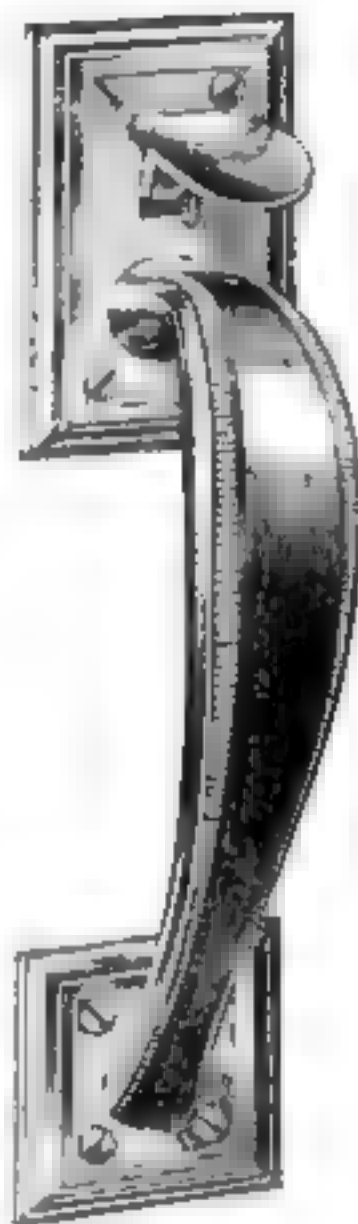


## Be SURE of your Hardware

ARE you one of the home buyers who know good hardware? Cheap hardware of plated steel comes out of its box clean and fresh. It looks good—for a while—but get beneath the surface. Cheap hardware never lasts. The tarnished metal; the discoloration on the door pointing a telltale streak of rust at the hardware that caused it; the faulty working of the lock—all these, in a few weeks or months, tell you the story of cheap hardware—but then it's too late.

How much better it is to be sure. Look for the mark YALE. Tell your architect or builder that you want Yale Hardware in solid brass or bronze. Make sure the name YALE is on it. That is the mark of good hardware worthy of your home.

For sale by dealers everywhere.



The Yale & Towne Mfg. Co.

Stamford, Conn., U. S. A.

Canadian Branch at St. Catharines, Ont.

# YALE

YALE MADE IS YALE MARKED



## A Striking and Conclusive Test of the Steel in NICHOLSON Files!

Twenty-five years ago, an Osage Indian in Oklahoma made this razor from a NICHOLSON File of regular stock, the braves using it to shave around the scalp lock.

Now, from the South, a man sends us samples of superior quality razors he is making from NICHOLSON Files.

Incidents like these, twenty-five years apart, prove conclusively that year in, year out, only the best file steel is used in NICHOLSON Files.

For shop or home, there is a NICHOLSON File for every need. Your hardware dealer will gladly help you select those best suited for your purposes.



**NICHOLSON FILE CO.**

PROVIDENCE, R. I., U.S.A.

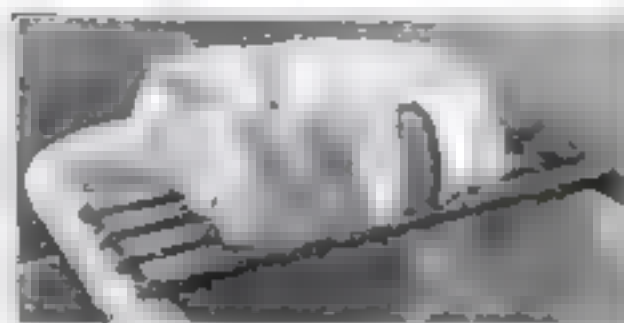
# NICHOLSON FILES

—a File for Every Purpose

**NICHOLSON**  
U.S.A.  
MADE IN U.S.A.

## The Home Workshop

### Platform across Large Tub Supports Baby's Bath



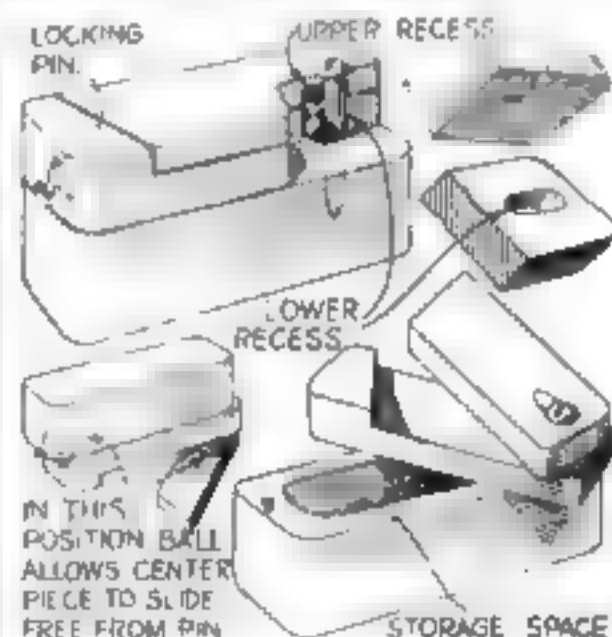
**M**OTHERS who bend over the bathtub in giving baby a bath can make it easier for themselves by having a platform or bench constructed to go across the top of the tub, as illustrated.

The wooden slats are fastened together by a strip of wood on the under side at each end. Baby's tub is placed upon the platform, which can be slid to one end of the tub or removed entirely when not in use.—J. G. P.

### Ball and Screw Provide Novel Lock for Curious Puzzle

**Y**OU can make the curious little toy bank, jewelry box, and puzzle illustrated below with nothing but a piece of waste wood, a wood screw, and a bearing ball.

The size of the original, which was made by A. J. Drake, of Sturgis, Mich., is  $1\frac{1}{16}$  by  $1\frac{11}{16}$  by  $8\frac{1}{2}$  in. over all. The lower block, containing the storage space, is 1 in. deep. The wood screw is  $1\frac{1}{4}$  in. No. 6,



This puzzling little box can be opened only when turned to get the ball out of the way.

and the steel ball is  $3/16$  in. in diameter. Of course, the puzzle may be made larger or smaller.

To open it is more of a trick than appears and even when some one accidentally stumbles upon the combination, he usually cannot succeed in closing the lid again.

Hold the box in the position shown in the upper drawing and turn it away from you until it is upside down. Then pull out what is now the lowest piece until it is at right angles to the rest of the box. It then is possible for you to slide the middle section to the right sufficiently to allow it to clear the locking pin, as indicated in the small drawing at the left.—J. B. Roswick, Sturgis, Mich.

# KODEL RADIO

The Emblem of  Worth in Radio

## Selling a New Radio Standard



**LOGODYNE** *\$90.00*  
"BIG FIVE"

*Five tubes, self-balanced tuned radio frequency, sloping panel gold engraved, beautiful, massive, Adam brown mahogany cabinet, compartment for batteries, stations already logged for easy tuning.*

Radio for years to come will not offer a better receiver than the LOGODYNE Big Five. Combining the utmost in performance with striking beauty of cabinet design, the LOGODYNE Big Five represents a triumph in radio engineering and artistry of manufacture.

No receiver could better express or exemplify the high standard to which the entire KODEL RADIO line is built—the best that radio offers.

**Free**

Send for the new edition of our free booklet "The Secret of Distance and Volume in Radio". Gives helpful interesting information on radio operation.

**THE KODEL RADIO CORPORATION**  
500 East Pearl Street Cincinnati, Ohio

**WKRC**

Owners of Kodel Broadcasting Station WKRC on the Alma Hotel. Send for program.



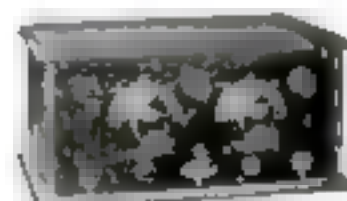
LOGODYNE "Big Five" Console Model—the Aristocrat of Radio—built-in loud speaker, compartments for batteries and charger. **\$275**



LOGODYNE "Standard Five" Console Model—beautiful brown mahogany built-in loud speaker, compartments for A and B batteries and charger. **\$165**



LOGODYNE "Standard Five" five tubes self-balanced tuned radio frequency gold engraved panel and sub-panel battery compartment handsome brown mahogany cabinet. **\$70**



KODEL "Gold Star" Models—  
Three Tube "Gold Star" Model. **\$30**  
Two Tube "Gold Star" Model. **\$20**  
One Tube "Gold Star" Model. **\$12**  
"Gold Star" Crystal Set. **\$ 6**



# Pride In Accomplishment

THE meter showed an increase! "Something wrong," said the Professor of a leading Institute of Technology. He was comparing current flow in Condensers. An expensive laboratory standard was placed in the circuit and readings taken, then a B-T Condenser substituted. And the meter showed an increase. A second B-T was tried and still the meter showed an increase.

"Laboratory Standard needs cleaning," said the Professor, "Try another." Same result. "Clean them up, check carefully"—and still a greater current flow,—showing conclusively that B-T stock condensers had lower resistances than laboratory standards.

We hold the Professor's signed statement—and we feel that such performance justifies a pardonable pride in our design and workmanship. That's why we have printed on every condenser carton "If you don't find it Better Send It Back."

## Satisfaction to the User

has always been our aim. You will not be disappointed in the B-T TANDEM if used in efficient circuits. Changing from two dials to one requires more than mere mechanical arrangement. Our Reputation is your best assurance that the design, balance, and operation of the vitally important "trimmers" answer the purposes intended and the necessities required. LD-13 (.00025 units) \$9.00 LD-17 (.00035 units) \$9.50

## B-T Straight Line Frequency Condensers

have the same qualities as those mentioned above, but with differently shaped plates. Some prefer them. The .00035 is used with B-T Torostyle Inductances. Note that the price is \$5.75



## Another Forward Stride

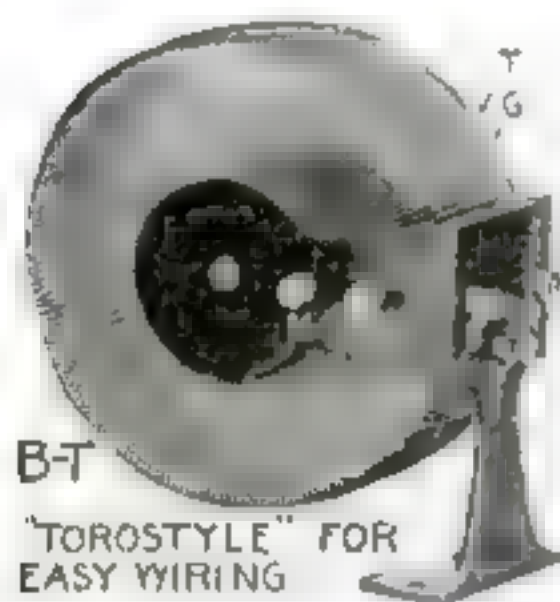
Six tube sets are not uncommon—but with three stages in the audio end. We claim the sixth tube belongs as a third stage of Radio frequency,—and the accomplishment of its control with only two tuning dials we believe will prove our greatest success.

The B-T "Counterphase" Circuit is covered by U. S. patents. It employs Torostyle Transformers, and can be built in five or six tube sets. The latter brings distant stations with ample volume on a short indoor antenna. The exclusive B-T method of oscillation control permits operation at the point of maximum efficiency at all broadcasting wave lengths.

## Years of Effort Yield Success

The B-T record—the first three circuit tuner, first air core transformer and first 3-circuit transformer, displays a basic knowledge of correct inductance design. Experience has broadened that knowledge—continued research has deepened it—but it was all needed in avoiding the pitfalls and developing the possibilities of the toroid coil. Here is another product when the wise buyer will pin his faith on the reputation of the manufacturer behind it.

The B-T Torostyle is arranged for easy wiring—and is built in three styles. TA Antenna Coupler, TC R. F. Stages and T-4 for 4-tube sets. Price \$4.00 each



B-T

"TOROSTYLE" FOR  
EASY WIRING

Send more information on the full B-T Line, including Tuning Controls, Universal Sockets, the new idea in Audio Transformers, etc. Send 48-page Booklet BETTER TUNING, 10c enclosed

Send "BETTER TUNING" one year 50c enclosed.

I am interested only in a factory-built set. Send information

**Bremer-Tully Mfg. Co.** ®  
532 S. Canal St. Chicago, Ill.









## In Hospitals and Homes Tycos THERMOMETERS Protect the Health of the Nation

**I**N ALL hospitals where the beds filled with patients stretch down the wards in long, orderly rows, the thermometer is the compass used by the doctors to help guide their patients through the dangerous channels of sickness.

Nowhere do *Tycos* Thermometers play a more vital role than in hospitals where the carefully charted temperature of the patient is the first thing the doctor looks at when making his rounds. The easily read figures, the proportion of tube to bulb, the perfection of the magnifying lens and the ease—consistent with safety—with which the column of mercury may be shaken down after use make the *Tycos* Fever Thermometers popular with doctors and nurses.

Important as they are in hospitals, *Tycos* Fever Thermometers are equally important in the home to guard the health of the children and the older members of the family.

### To Manufacturers

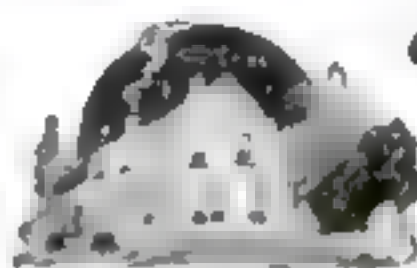
The same accuracy that makes *Tycos* Fever Thermometers the protectors of the health of the nation is available to manufacturers of all products that go through processes demanding accuracy of temperature control. In the *Tycos* line of 8000 different kinds of Heat Indicating, Recording and Controlling Instruments—the Sixth Sense of Industry—there are instruments that will help you produce absolutely uniform products. Whether you bake bread by the mile, make candy by the ton, can fruits or vegetables by the carload, or use heat in your manufacturing processes for any purpose, it will pay you to learn how other manufacturers are using the Sixth Sense of Industry to get the uniform results essential to manufacturing on a large scale.

Informative literature on any type of instrument will be sent you on request. Or our engineer will consult with you on the application of *Tycos* to your particular manufacturing problem.

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Manufacturing Distributors  
in Great Britain.

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## Tycos— for the Home

*Tycos* Office Thermometers  
An aid in promoting  
human efficiency

*Tycos* Bath Thermometers  
To enable you to get  
the most good from  
your bath.

*Tycos* Home Set  
Bake Oven Thermom-  
eter, Candy Thermom-  
eter, Sugar Meter. The  
secret of accurate re-  
sults in cooking.

*Tycos* Wall Thermometers  
To help you maintain  
a temperature in your  
house conducive to  
good health.

*Tycos* Quality Compass  
To show you the right  
way in unfamiliar  
country.

*Tycos* Fever Thermometers  
A necessity in every  
home.

*Tycos* Thermoguide  
Forecasts the weather  
twenty-four hours  
ahead with depend-  
able accuracy.

*Tycos* Hygrometer  
To enable you to keep  
the humidity of the  
atmosphere in your  
home correct at all  
times.

Your dealer will show them to you. Ask us,  
on a postal, for booklets on any of the above.

## Tycos— for the Medical Profession

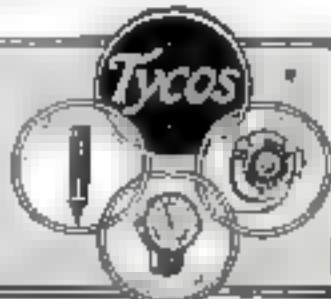


*Tycos* Sphygmomanometer, Pocket and Office  
types

*Tycos* Urinalysis Glassware

*Tycos* Fever Thermometers.  
Bulletins on request

THE SIXTH SENSE OF INDUSTRY  
**Tycos Temperature Instruments**  
INDICATING • RECORDING • CONTROLLING





# It is not a "Hot Shot" unless it is an Eveready Columbia



WHEN you ask for a "Hot Shot" Dry Battery, it will pay you to make sure you get one. Any group of dry cells connected in a package is not a Hot Shot. "Hot Shot" is a trade-marked name and means only Eveready Columbia. Hot Shots come in three sizes, containing 4, 5 or 6 cells, giving 6, 7½ or 9 volts. In a neat, durable, water-proof steel case

with convenient carrying handle. Every one is labeled "Eveready Columbia Hot Shot." Experienced battery men prefer these batteries because of their superior service—they last longer. It will pay every dry battery user who needs 6, 7½ or 9 volts to ask for Hot Shots and to make sure of getting them. There is an Eveready Columbia dealer nearby

Manufactured and guaranteed by

**NATIONAL CARBON COMPANY, INC.**  
New York San Francisco

Canadian National Carbon Co. Limited, Toronto, Ontario

gas engine ignition  
motor boat ignition  
tractor ignition  
starting Ford  
lighting tents and  
outbuildings

running trolleys  
telephones and  
telegraphs  
doorbells  
buses  
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## EVEREADY COLUMBIA Dry Batteries

*—they last longer*

### AGENTS NEW SPARK PLUG

**Victor Flash**  
Just Out! Amazing Invention.  
**Beacon Light Spark Plugs.** You see the flash of each explosion in the cylinders. Tells which are bad right. Greatest improvement in spark plugs ever. Invented. Warranted.

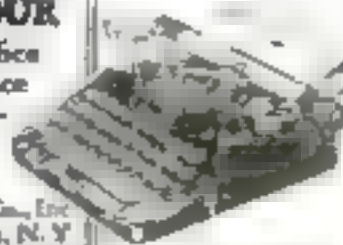
**\$90 A WEEK**  
Easy to make with new sure-fire. Sells on sight to every auto owner. Phillips, Ont., writes "Sold 10 in 1 day. 1 dozen yesterday. Rush 10 dozen." Write for special Free Demonstrator Offer and FREE deal book. Also, 1000's of spark plugs to make for 10¢ each. Write for it today.

**CENTRAL PETROLEUM COMPANY**  
1638 Century Building Cleveland, Ohio

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With standard office keyboard—an office typewriter in portable form.

Write for literature.  
Corona Typewriter Co., Inc.  
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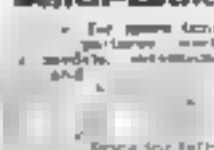


### Turn Your Ideas Into Money



Write for literature.  
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### Wade Bench-Lathe



Write for literature.  
Pierce for Father

## The Home Workshop

### A "Two-Tone" Radio Cabinet

(Continued from page 103)

for this purpose. Six ordinary dry cells will fit in one compartment and two small size 45-volt B batteries will go into the other.

When the construction is completed, sandpaper the cabinet thoroughly, finishing off with No. ½ or finer paper.

For finishing the cabinet you will need ½ pt. each of dark mahogany and light oak wood dyes or stain, although only a small portion actually will be used; 1 pt. white shellac, 1 pt. denatured alcohol, a little putty, a few sheets of No. 00 or finer sandpaper, a little powdered pumice-stone, ¼ pt. lemon oil, one soft bristle brush, and one small cheap artist's brush.

Dust the cabinet well and apply the mahogany stain to all surfaces except the doors. Do one section at a time and work quickly to avoid laps.

While the cabinet is drying, draw a 1-in.-wide border around each door ½ in. from the edge, using pencil and ruler



Details of the cabinet. The dimensions of which it may be modified to suit any pane.

Then draw the diamond-shaped design in the center, keeping the points about 1 in. away from the edges. With pocket-knife and ruler cut quite deeply on the pencil lines and then enlarge these cuts with a sharp pointed file or other tool. With the smaller brush, color the background of the doors as shown, using the mahogany dye. Be careful not to let the color run into the border or the diamond. The indentations previously made are to aid in keeping the color from spreading.

Clean the brush and apply the light oak stain to the remaining areas, which are to be very light in color. It will do almost as well to stain these with very light mahogany dye. This can be made by greatly diluting the dark dye with either turpentine or alcohol, as specified by the manufacturer. In that case the cost of the light oak stain can be saved. The idea is to have a decided contrast between the design and the background on the doors, giving the two-tone effect now so popular. It is well first to practice applying these two tones on a scrap piece of wood.

Color a little putty with the mahogany stain until it matches the cabinet and fill the nail holes and any open joints

(Continued on page 104)







**The Season's Sensation**

**THE KODEL MICROPHONE LOUD SPEAKER**

is an exact replica of the transmitting microphone used in broadcasting.

The efficient Kodel reproducing unit with an ingeniously new small shell horn, mounted inside the microphone case, produces a remarkably clear full-toned volume. Non-vibrating tone chamber eliminates distortion.

The \$13 model incorporates the new Kodel Jr. unit with the large Kodel unit, \$28.

Radio dealers everywhere have them.

**THE KODEL RADIO CORP.**  
500 E. Pearl St., Cincinnati, O.

**\$15.00**

**The KODEL MICROPHONE LOUD SPEAKER**

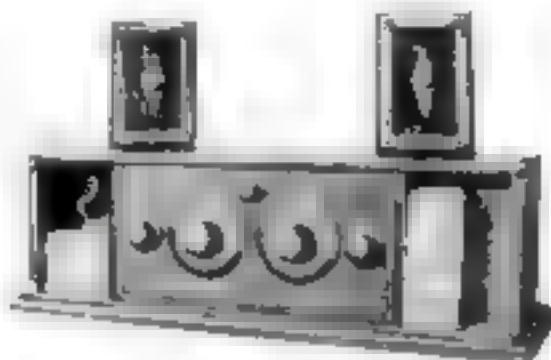
## The Home Workshop

### A "Two-Tone" Radio Cabinet

(Continued from page 104)

Pour white shellac into a dish and add about one-third as much alcohol. Apply this to each section separately, using long strokes and working very quickly, as the shellac sets almost at once. Do not try to go over or touch up any places you have missed. This one coat of shellac is sufficient for the inside of the cabinet except the inside surface of the cover, which should be finished fairly well, as it will show when open.

Give the cabinet four or five more coats of shellac, sandpapering and dusting thoroughly between each coat, as this is the secret of obtaining a good finish.



The removable battery compartment doors which are given an attractive two-tone finish.

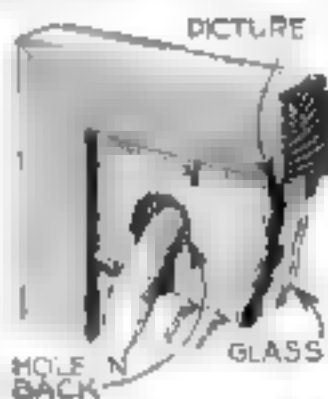
The last two coats of shellac need not be thinned. Allow several hours between coats for the shellac to dry and let the last coat stand overnight.

The next step is to polish the cabinet by saturating a clean, soft rag with the lemon oil, sprinkling a little powdered pumice-stone on the wood and rubbing it briskly with the oily rag until the finish appears to be smooth. This takes off the high gloss, but gives a rubbed effect with a moderate gloss such as often is seen on the most expensive furniture. Remove all the grit with a clean, dry rag. A nickel, silver, or gold-plated knob is fastened in the center of each door.

Finished in this way, the cabinet will always maintain its excellent appearance.

### Simple Trick Aids in Squaring Picture in Its Frame

**IN FRAMING** pictures, the placing of the back piece of cardboard or wood often moves the picture itself a trifle so that it is no longer square with the frame. Every home worker who has attempted to frame pictures has experienced this difficulty. It can be overcome by a simple trick of boring or cutting holes in diagonally opposite corners of the back. Having placed the picture and back in the frame, drive in a few brads lightly, turn the frame over and then center the picture accurately by shifting it as necessary with the finger-tips through the holes. Then finish bradding down the back. **LOUIS SCHNEIDER, Clinton, Mo.**



**10¢ LEARN ELECTRICITY**

A twenty-five cent book, "Electricity and Magnetism" key to electrical knowledge and small motor building. For a short time only.

**10¢**

**Knapp Electric Corporation**  
Dept. 106 Fort Chester, N. Y.



### Tool Cases

for Mechanics, Carpenters and Tool Makers—none better, sturdy styles. Quartered oak and metal covered. Ask for booklet.

"Built for Service"  
The Palmetto Lumber Co., Sumter, S. C.

### LATEST WHOLESALE RADIO CATALOG

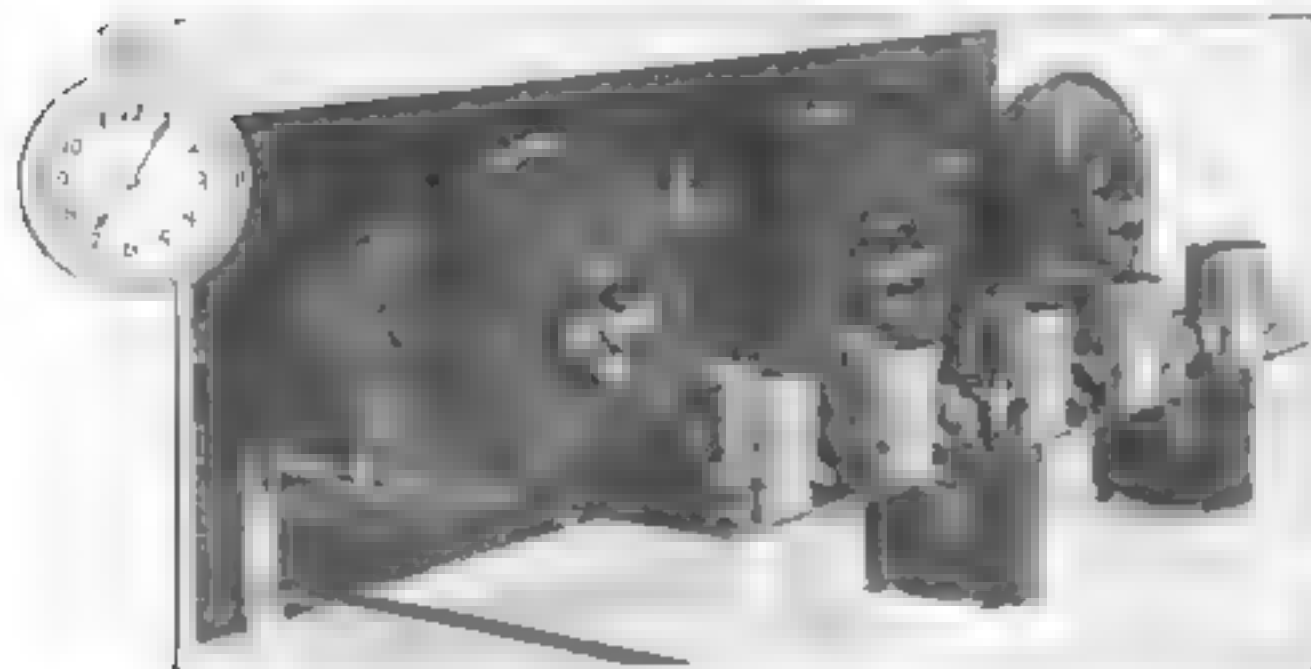
**FREE** Simply send name TODAY for big 48-page catalog of latest radio goods at Wholesale. Live dealers and agents wanted. STANDARD RADIO CO., 104 East 12th, Kansas City, Mo.

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If so the WORLD PROGRESS will send you upon request sample copy free containing suggestions to inventors as to Inventions Needed. We make manufacturers to address or regarding where they want. Subscriptions for our year 60 cents. **WORLD PROGRESS PUB. CO., INC.** Room 202 Victor Bldg. Washington, D. C.

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Everyone wants one of these revolutionary receivers that are amazing engineers with their results. Designed on a newly discovered principle. Now you may build your own in a surprisingly short time from one of these remarkable kits. Send for new free book that tells how.



The new Erla Circluid Five Factory Built Kit—as you receive it. Ready-cut, flexible, solderless leads and charts enable you to wire it in an evening. Price \$49.50

HERE is an easy way to have the new radio that is astonishing radio fans everywhere. You make a big saving and have the fun of building your own set besides. It takes only a short time—from 45 minutes to an evening—depending on the kit you select.

There are one to five tube kits at strikingly low prices. No wire bending or soldering. Merely set up the parts, then attach a few ready-cut flexible eyeletted leads and the job is done.

The amazing new inductance principle found in these kits is based on a different kind of coil—the Erla "Balloon" Circluid. It belongs to Erla alone. No other set regardless of price, can offer it to you. Four striking advantages result.

1. **Greater Distance.** Circluids have no measurable external field to affect adjacent coils or wiring circuits. This makes possible higher amplification in each stage, with increased sensitivity and greater range.

\*Trade Mark Registered

**Dealers**—Exclusive franchises are available to high class dealers in localities still open. Write or wire immediately.



This sign identifies authorized Erla distributors. All are equipped to give complete radio service.

2. **More volume.** Higher r. f. amplification enables Circluids to bring in distant stations scarcely audible in ordinary sets with volume on the loud speaker to fill an auditorium.

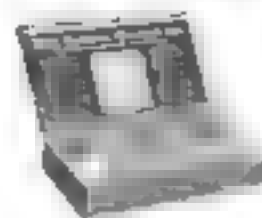
3. **Increased Selectivity.** Circluids have absolutely no pick-up qualities of their own. Only signals flowing in the antenna circuits are built up.

4. **Finer Tone Quality.** The self-enclosed field positively prevents stray feed backs between coils. Hence no blurring or distortion. Tones are crystal clear.

**Write for free information on kit—also book**

See how a few minutes of fun will give you the newest and most phenomenal set known to radio science. Examine it at any Erla dealer's, or send the coupon for full information, illustrations and diagrams contained in the remarkable book, "Circluid Hookups."

## Erla Kit No. K-10



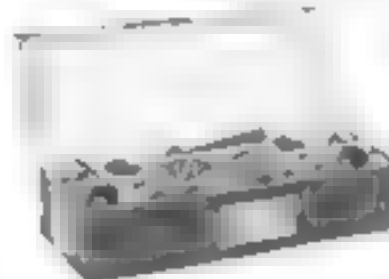
Consists of 2 Erla Balloon Circluids (coupler and 2 transformers). Full instructions for installing on your present receiver are included. Price \$12

## Erla Kit No. K-13

Consists of 2 Erla Balloon Circluids (coupler and 2 transformers) and 2 6000 to plate 12.6 Mini lamp. Complete instructions for installing on each box. This combination is a 3 unaphon kit receiver. 1 for \$24.00.



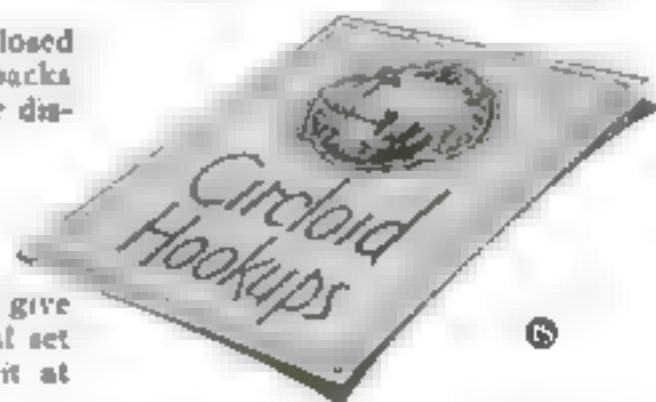
## Erla 3 Tube Cir-Kit



Contains absolutely every part used in the complete Circluid 3 Tube kit. It is a self-contained kit with an engraved label to tell you what to do and how to do it. No wires and wire. Every part is 4 and approved in our inspection and guaranteed.

## NOW FREE

Get this book telling about the newest scientific radio discovery. See the many circuits in which it can be used. Make the tests that prove the four great advantages it brings. The edition is limited, so write immediately.



Electrical Research Laboratories,  
2500 Cottage Grove Ave., Dept. 12-A, Chicago, Ill.

Send me the new book explaining the revolutionary radio principle recently discovered; also various Circluid hookups.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

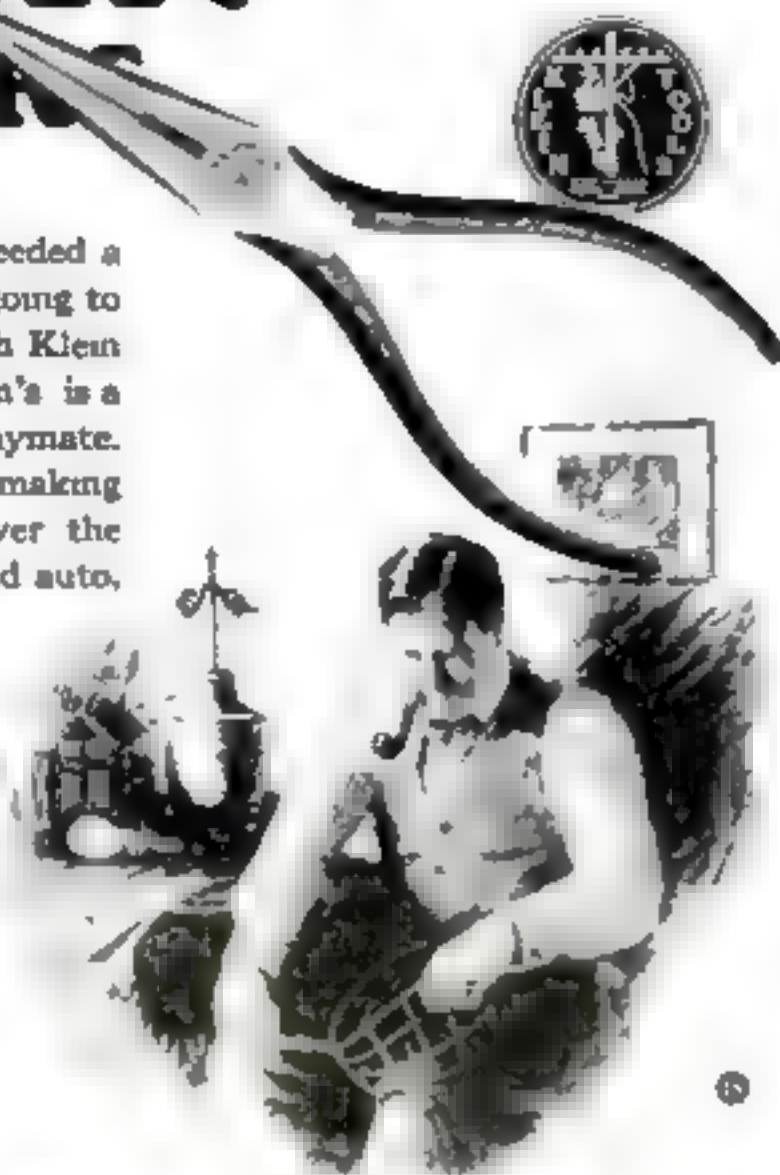
County \_\_\_\_\_

State \_\_\_\_\_



# KLEIN PLIERS

That lamp has always needed a new shade and now it's going to get it! Easy enough with Klein Pliers. A pair of Klein's is a real worker and a real playmate. You'll enjoy them for making and fixing things all over the house—for your radio and auto, too. They're thoroughbreds, are Klein Pliers—the result of sixty-seven years of manufacture of pliers. Electrical and telephone companies all specify them. Pick up a pair when at your hardware dealer's.



Mathias **KLEIN** & Sons  
Toolmakers

## A new Parks! Cabinet Shop Special

No. 7

\$250

Illustrated  
with  
motor



THE MOST POPULAR MACHINE PARKS EVER BUILT! A winner from the start. A real machine, yet convenient size for the small shop. Does everything in woodworking. Has circular rip and cut-off saw, 6-inch jointer, 16-inch bandsaw. Lathe and shaper attached if desired at small cost. Operates from any light socket. Just plug in and go to work!

Write for interesting circular

The Parks Ball Bearing Machine Co.

1547 Knowlton St., Cincinnati, Ohio  
Canadian Factory: 391 Notre Dame East, Montreal, Canada

# PARKS

WOODWORKING MACHINES

## A Revelation in Tone—Volume—Clarity

The Kellogg Symphony Reproducer brings the broadcasting studio into your very room, so realistic is its reproduction.

Piano music, the most difficult to reproduce, sounds so natural that you are completely carried away by its beauty.

Vocal selections retain all of the tone colorings of the artist.

Orchestra music is indeed a recreation, every instrument can be heard, clear and full.

Magnetic diaphragm control—used exclusively in the Kellogg unit—is the new principle that performs wonders in radio reproduction.

Compare it with others at a like price and note the difference—\$20.00 each.

At your dealers—Hear one today.

The Kellogg Switchboard &  
Supply Company

1066 W. Adams St. Chicago, Ill.

## How to Make a Wooden Press for Pop-Corn Cakes

By Charles C. Hall,  
Captain, U. S. A., Retired

**P**OP-CORN bricks that can be eaten without sticking to the hands and giving off countless crumbs, can be made quickly and easily in the wooden press illustrated.

The materials required are a board 1 by 5 by 24 in., another 1 by 4 by 24 in., and a third  $\frac{3}{4}$  by  $4\frac{1}{4}$  by 20 in., all of which should be of oak or other hard wood; one piece of wood 1 in. square and 5 in. long, one piece  $1\frac{1}{2}$  by 2 by 9 in., and two blocks 1 in. thick and  $8\frac{3}{4}$  in. square.

Cut a notch  $1\frac{1}{2}$  by 2 in. in one end of the 1 by 5 by 24 in. piece. Measure back from the



The crisp delicious pop-corn bricks that children love so well can be made quickly in this simple wooden press.



same and  $8\frac{3}{4}$  in. and bore a  $1\frac{1}{4}$ -in. hole. Taper off the other end for a handle.

In one end of the other 24-in. piece cut a similar notch. Measure 8 in. from the same end and cut a square cornered hole  $1\frac{1}{2}$  by  $1\frac{1}{2}$  in. At the other end form a handle.

From the 20-in. long board cut 4 pieces 5 in. long and after drilling holes, screw them together to form a box 5 in. square. Fasten this on the 1 by 5 in. piece previously prepared so that the hole is exactly in the center of the box.

Make a square cornered hole  $1\frac{1}{2}$  by  $1\frac{1}{2}$  in. in the center of one of the  $8\frac{3}{4}$ -in. blocks and bore a 1-in. hole in the center of the other. One is the plunger and the other is the ejector block.

Bore  $\frac{3}{4}$ -in. holes at each end of the  $1\frac{1}{2}$  by 2 by 9 in. piece and corresponding holes in the ends of the handle pieces, so that they can be fastened together with  $\frac{3}{4}$ -in. bolts or iron pins as shown.

Insert one end of the 1 by 1 by 5 in. piece in the hole or mortise in the upper handle piece and bolt or pin it in place.

(Continued on page 110)

# THORDARSON

**Unconditionally Guaranteed**  
*Super*  
**AMPLIFYING TRANSFORMERS**  
*Standard on the majority of quality sets*

## Colin B. Kennedy says:

"We are cranks on audio-frequency transformers and our engineers are constantly running comparative tests on them. The fact that we continue to use Thordarson's exclusively, in ever increasing numbers, simply means that we believe that it is the best available at this time."

from a letter dated May 29, 1925, written by Mr. Colin B. Kennedy, President of Colin B. Kennedy Corp., St. Louis, Mo.

## Follow the Lead of the Leaders!

**Build or replace with Thordarsons**

Leading set builders have scientific laboratory apparatus to test, compare and prove the facts about transformers. They continue to use more Thordarsons than all competitive transformers combined. Doesn't this answer the amplification question?

Don't we hear from fans who paid high prices for musically named, fancy-looking transform-

ers only to discover that their old standbys—Thordarsons—were the real music instruments. For the benefit of others we therefore repeat "when better transformers can be bought they will be Thordarsons." Few if any transformers actually cost as much to make as Thordarsons. Why, then, pay more? Any store can supply you. If dealer is sold out, order from us.

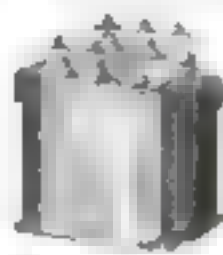
## TYPES AND PRICES



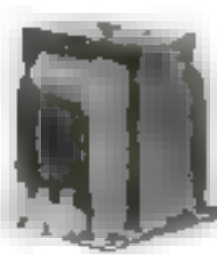
Thordarson Super Audio Frequency Transformer, sub-panel or top mounting types 2-1 \$3.32 4-1 \$3.34



Thordarson Power Amplifying Transformer, sub-panel or top mounting types 1-1 Thordarson A. F. Transformer Pair \$10

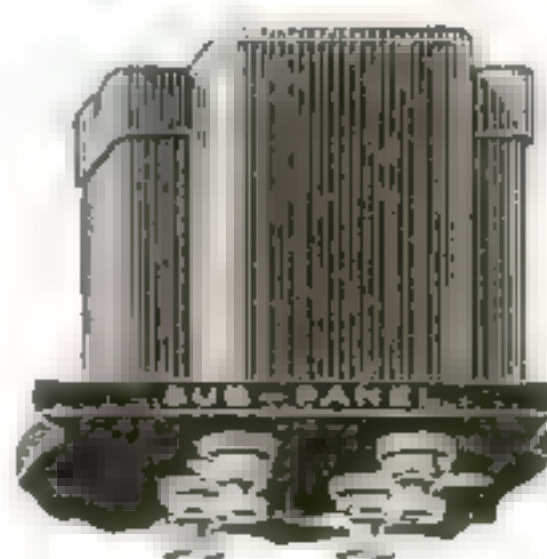


The Thordarson INTERSTAGE Transformer, Power Amplifying Transformer, Pair \$10.50. These are the standard in the market between many and the other Power Amplifying transformers. Four tubes are required, but the quality of the second is more than repays you. Only Thordarson builds a transformer of this type. Each \$5



Thordarson Audio Transformer, amplify clearly in a wide range of an instrument as perfectly with high notes. They amplify with even magnitudes all notes within range of the human ear. A new idea developed by Thordarson. Write for the Audio Transformer Hookup Bulletin. Audio transformers are \$5 each

**KENNEDY**  
*Radiodyne*  
*Planstiehl*  
*Howard*  
*Thermodyne*  
**GLOBE**  
*Deresnadyne*  
**ADLER-ROYAL**  
**MURDOCK**  
**MU-RAD**  
**Valley**  
*Silver-Marshall*  
**OZARKA**  
**ULTRADYNE**  
**Newport**  
**LEICH**  
**NUNN-LANDON**  
**KUSTOMBILT and many others**



**SUB-PANEL MOUNTING TYPE THORDARSONS NOW ON SALE**

They permit a neater assembly, the elimination of leads and the convenience of wiring as in factory built sets. Same famous Thordarson standard type Thordarson, if dealer cannot supply, order from us.

### Super-Hot Builders!

For the "Best 45,000 Cycle Super-Heterodyne 'Radio' and other leading authorities recommend a highest terms the Thordarson 2-1 Ratio Transformers. Take no others.

Write for latest Thordarson bulletins on amplification. Thordarson dealers everywhere.

**THORDARSON ELECTRIC MANUFACTURING CO.**  
*Transformer Specialists Since 1895*  
**WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS**  
**Chicago, U.S.A.**



# Pay Less for LATHES of Highest Quality

Built on the **SOUTH BEND** Standardized Production Plan

South Bend Lathes are modern lathes built in quantity and brought down a price of modern manufacturing methods. They are as outstanding in quality, accuracy and performance as they are in price.

Prices Quoted Change Gear Lathes			
8" x 3' Lathes	\$241.00	15" x 7' Lathes	\$447.00
11" x 4' "	288.00	16" x 8' "	495.00
13" x 6' "	366.00	18" x 10' "	721.00

Easy Payments if desired. Write for Catalog No. 34

**South Bend Lathe Works,** 814 E. Madison Street, SOUTH BEND, IND.



## Only \$5

Buy any WITTE ENGINE up to 30 H. P. on Kerosene, Gasoline, Distillate or Gas. Equipped with celebrated troubleproof WICO Magneto. Simplest and cheapest to operate. New device makes starting easy. 22 to 25 H. P. all at one price. Solid direct from factory. No repairs. **FREE BIG NEW ENGINE BOOK NINETY DAYS' FREE TRIAL.** Write today for the new illustrated engine book. Sent absolutely free. No obligation to you.

**WITTE ENGINE WORKS**  
2235 White Building, KANSAS CITY, MO.  
2235 Empire Building, PITTSBURGH, PA.



## That Extra Pair of Hands



LET a Luther Vise be that "extra pair of hands" you always wish you had when you tackle a mean "fixing" job—whether it's taking apart a spark plug, loosening a rusted-on nut, or filing down a metal part of some kind. This sturdy, tight-holding vise has a wider jaw spread and a larger feed screw than any other vise of equal size, and has an extra-strong patented slide bar. A clean-built, husky work-pal that never goes back on you—saves you many a skinned knuckle and makes any number of little jobs easier. Four sizes: jaw spreads of 1½", 2", 2½" and 3". Sold by most good hardware stores.

Write for free copy of interesting booklet, "Tighten Up", and name of store nearest you that sells Luther Vises.

**LUTHER GRINDER MFG. COMPANY**  
Department A Milwaukee, Wis.

# Luther

QUALITY-BUILT VISES

## 21 Jewels!

Nothing less than 21 Ruby and Sapphire jewels is good enough for the BURLINGTON masterpiece.

**Quality and Style**  
Adjusted to second temperature, low humidity conditions, 25-year gold standard case, in 18 designs. Unsurpassed quality, rock bottom prices. \$1 down keeps your choice. Balance to small monthly sums.

**Send for FREE Book**  
Write today for FREE Burlington Watch Book. Find out about this big special offer made for a limited time!

**Burlington Watch Company**  
100th Street and Marshall Blvd., Chicago, Illinois  
Dept. 17-27



## The SAAL Soft SPEAKER

Volume with tone quality

You need no longer object to loud speakers because of their harshness. Hear the Saal at your dealer's today. It combines volume with a velvet tone. It's built to last a lifetime.

**H. G. SAAL COMPANY**  
1800 Montrose Avenue - Chicago



## Home Workshop

### Press for Pop-Corn Cakes

(Continued from page 108)

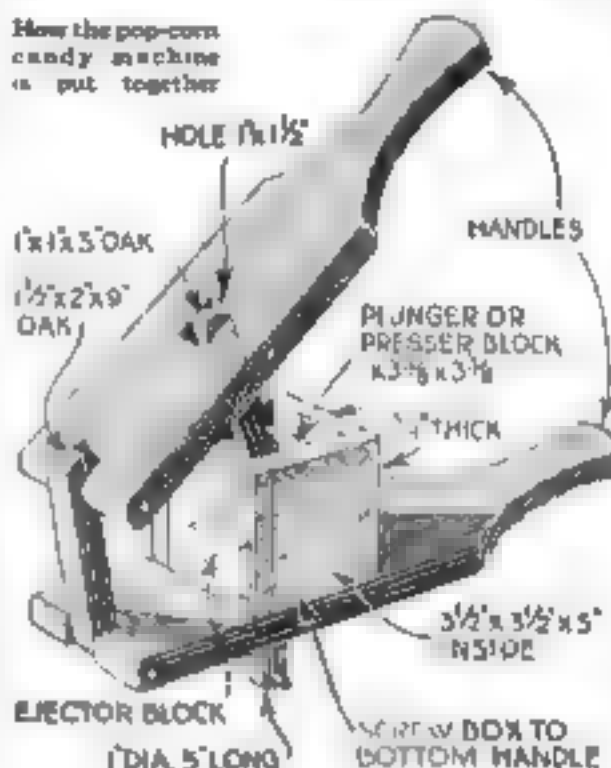
Fasten the other end similarly in the hole in the plunger block, using an iron pin.

Fasten a 5-in. length of broom handle to the ejector block and let it project through the bottom of the box.

To make about 18 bricks, pop 8 qts. of corn. Take 2 cups of molasses, ¼ cup sugar, and 1 tablespoon of vinegar, and cook until the syrup hardens in water but is not brittle. If dark molasses is used, it is well to add ¼ teaspoon of soda to improve the color. Pour the syrup over the corn in a large vessel and stir.

Grease the square box with butter, fill it with sufficient corn to make a brick and press the handles together. Then push

How the pop-corn candy machine is put together



up the broomstick connected with the ejector block and remove the brick with a slight twist. The resulting brick, which will be about 1 in. thick and 3½ in. square, should be wrapped in waxed

### How to Repair Leak in a Copper Ball Float

THE COPPER ball float used in a bathroom flush tank sometimes springs a leak and fills with water. As it is difficult to find the leak by ordinary methods, punch a small hole in the float and blow into it hard enough to force the water out of the leaking hole. When the water has been removed in this way, it is a simple matter to solder both holes—

C. W. HUBERTZ.

### Making Christmas Presents

YOUR home workshop never is more useful than when you are preparing for Christmas. It is not too soon to start work on the gifts you plan to make. You will find many suggestions in this issue and many more in the November and December numbers. There will be articles on toys, games, furniture of various kinds, jewel boxes, radio cabinets, kitchen equipment, greeting-cards, and novelties.

*Again* They said  
it couldn't be done!

Here it is

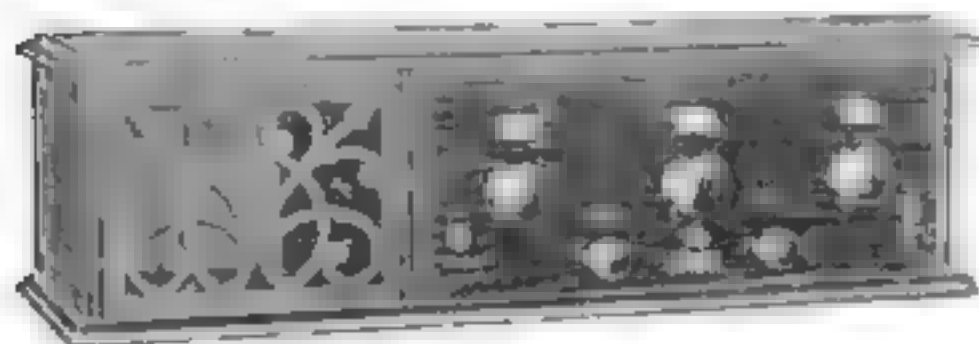
New and Improved  
**FRESHMAN**  
MASTERPIECE

But now . . .

Complete with built-in loud speaker of great volume and superb tone quality.

Encased in . . .

As fine a heavy genuine solid mahogany cabinet as ever graced any radio set.



Model  
5-F-5

At sixty dollars . . .

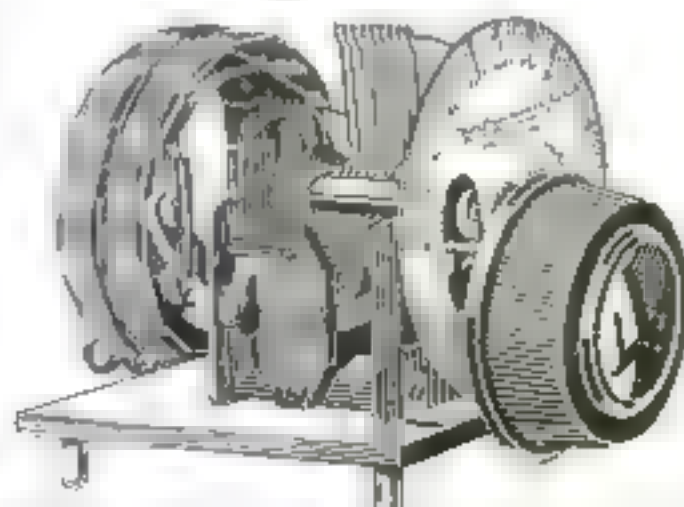
Not only complete with built-in loud speaker and massive mahogany cabinet, but this wonder circuit has been scientifically perfected and each and every single part strengthened and co-ordinated.

For example . . .

The new Freshman Masterpiece straightline wave length condenser with vernier attachment which assures hair-line selectivity—permitting you to tune in the station you want without interference over the entire wave length range. This is merely one exclusive feature of this New and Improved Freshman Masterpiece Receiver

For sale at **AUTHORIZED FRESHMAN** dealers only

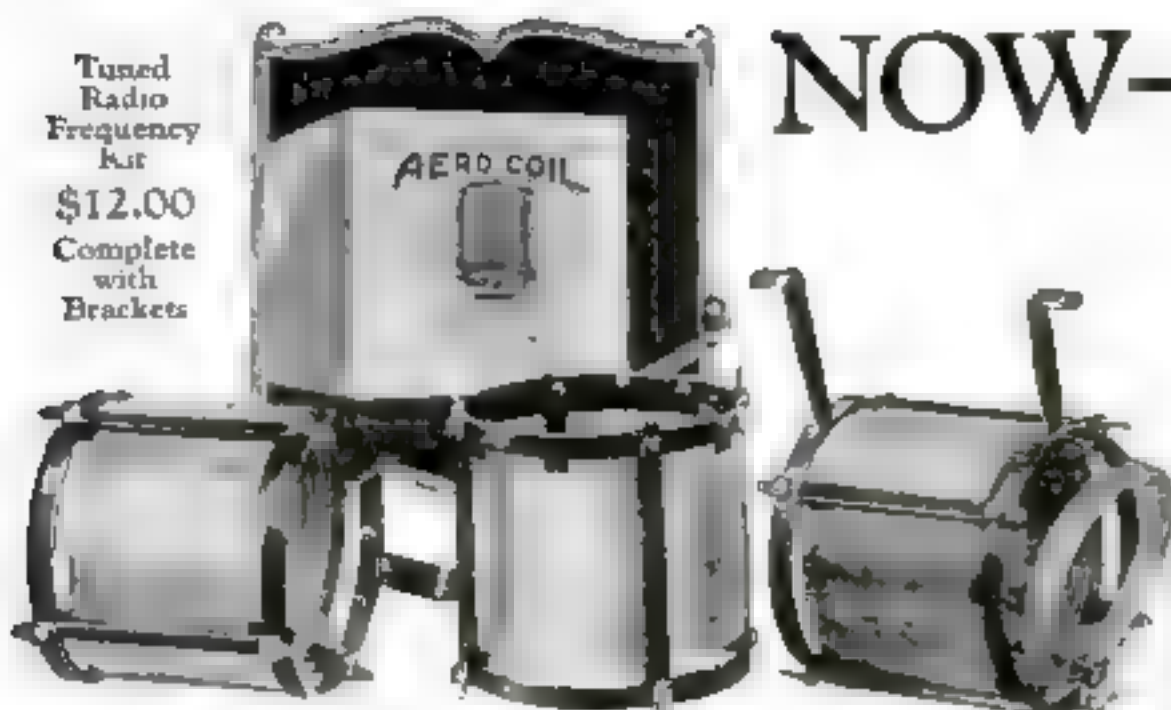
Chas Freshman Co. Inc.  
Radio Receivers and Parts  
FRESHMAN BUILDING  
240-244 West 40th St.—NEW YORK, N.Y.  
CHICAGO OFFICE: 327 S. LA SALLE ST.







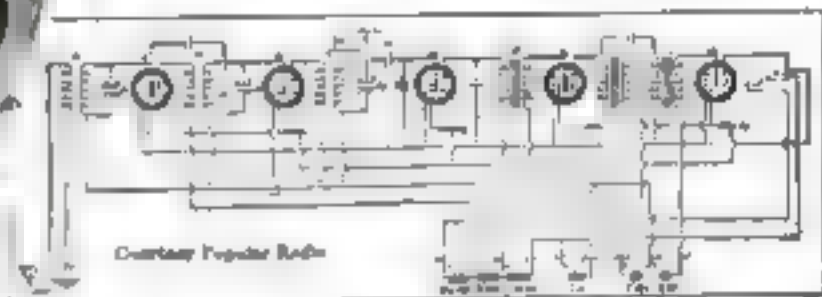
Tuned  
Radio  
Frequency  
Kit  
\$12.00  
Complete  
with  
Brackets



The complete Low Loss Inductance System, comprising two tuned circuit transformers and an antennae coupler with a uniquely constructed variable primary for governing the selectivity of the antennae circuit.

# NOW—All the world can have it!

The sensational favor which Chicago and New York showered upon the AERO COIL, has prompted its designers to make it available to every fan in the Nation. Vigorous plans are, therefore, under way to place the Aero Coil where every city and village can see it and witness its markedly superior performance.



## Acclaimed by Chicago and New York for its greater SELECTIVITY, POWER and SENSITIVITY!

Enjoy the "knife-edge" selectivity with which Aero Coils cut through the tangled mass of Chicago and New York broadcasting at will! Enjoy the uncanny sensitivity with which sets built of Aero Coils pick up the far off, small, low-wattage stations that you never thought existed! Be thrilled by the amazing volume with which Aero Coils amplify for the loud speaker, reception which you have always had to listen to on the head phones! Build a 5-Tube Tuned Radio Frequency Set with Aero Coils . . . . . the true low loss inductance system.

### PATENTS PROTECT ITS SUPER-EFFICIENCY

Its lower circuit resistance, its lower high frequency resistance, its lower distributed capacity, and the fact that its dielectric is 95% air are the reasons why the Aero Coil tunes so sharply into resonance—and why it actually uses the energy which other types of inductances waste. Hence, Aero Coil is the inductance of today—and tomorrow, and you can be assured that it is—for the construction which makes it the ideal inductance is patented, and no inductance can be made like Aero Coil unless in violation of these patents!

**95% Air dielectric**—No dope on windings—All tubes air-spaced—Soloidal cylindrical inductance—Variable primary. Engineers recognize cylindrical winding to be superior to any other. The Aero Coil is the only Air dielectric cylindrical inductance with a variable primary. Aero Coil patents prevent imitation.

### Build Your Set Now!

The construction which makes possible the far superior results obtained from Aero Coils also makes them cost a bit more—but, performance considered, their price is low. \$12.00 for a set of three, complete with nickel plated mounting brackets which fit any condenser. Go to your dealer's today and obtain a set of three. A circular containing complete

bookings for building a more selective, more sensitive, more powerful five-tube receiver is enclosed in each package.

If your dealer has not yet obtained his stock of Aero Coils, order direct, enclosing price with your order.

Free Booklet showing new circuits and giving full constructional information of help to any fan or set builder—mailed on request. Write for the Aero Booklet.

**AERO PRODUCTS, Inc.**  
217 North Desplaines Street, Chicago, Illinois

Successors to  
**HENNINGER RADIO MFG. CO.**

Pacific Coast Representative  
**S. A. WINSOR, 1221 W. 16th St., Los Angeles**

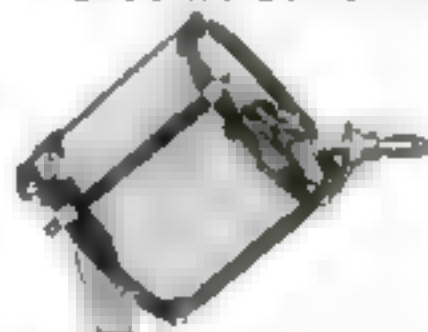
# AERO COIL

All Aero Coils embrace a patent-protected method of construction which makes possible a far more efficient inductance performance than is possible with other types of coils.

## Use AERO COILS Wherever An Inductance Is Required

[THE ONLY AIR DIELECTRIC COILS HAVING  
VARIABLE PRIMARIES IN ANTENNAE  
CIRCUITS]

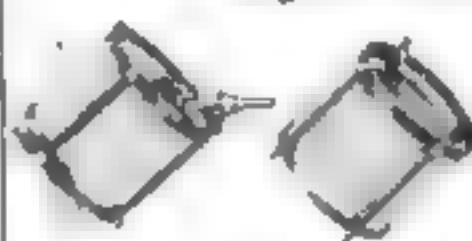
### The Aero Coil 3-Circuit Tuner



A 3-tube set brought in Havana, Cuba, in the daytime in Chicago. Price . . . . . \$2.00

Another adaptation of the patented protected Aero-Coil construction and for that reason a marvelously efficient three-circuit tuner. More than covers the broadcast wave band when shunted with a good .001 condenser. This is the tuner which in the tuner which in Price . . . . . \$2.00

### The Aero Coil Radio Frequency Regenerative Kit



Consists of one AERO COIL 3-Circuit Tuner and one AERO COIL Antennae Coupling Transformer. Makes more powerful, more selective 4 tube, non-radiating set. Price . . . \$12.00

### The Aero Coil Wave Trap Unit Also for Crystal Sets



By reason of the characteristics made possible by the Aero Coil construction this unit makes a very efficient wave trap or crystal set. Price \$4.00

### The Aero Coil Oscillator for Super Heterodynes



The characteristics achieved through the use of the Aero Coil principle make of his instrument the ready means to tremendously increase the efficiency of the oscillator circuit in any Super Heterodyne receiver. Price \$5.00

Patented by AEROLAND-ENGEL ADVERTISING COMPANY CHICAGO





## How to Pick a Hammer

**YOU'RE** proud of your personal kit of tools. Every "regular fellow" is. And so it pays to be especially particular when selecting the tool that's most in evidence because most used—your hammer.

Before you buy a hammer balance it in your hand; heft it; swing it. Has it a "hang" that makes you itch to come down on a nail and drive it home?

Is the head *press-forged*, not drop-forged? Has each end of the head a special temper to best fit it for the work it is intended to do? And the handle, is it of clear hickory, free from knots or blemishes, and not stained to cover up imperfections? And is it put on for good?

There's only one hammer that answers "yes" to all these questions. But it's easy to identify. The name "D. Maydole" is stamped on the head. Be sure it's there before you buy.

Your dealer sells and recommends the genuine Maydole Hammer. Ask him to show you the size and style you want.

Have you a copy of our interesting Handbook and Catalog No. 23 "B"? If not, send us your name and address.

THE DAVID MAYDOLE HAMMER CO.  
Norwich, New York

**Maydole  
Hammers**



### Winners in Profitable Home Workshop Job Contest

**WHAT** the average home workshop is worth in dollars and cents—the money that is saved or earned through it—was demonstrated more vividly and impressively than ever before in the contest for POPULAR SCIENCE MONTHLY's readers on "My Most Profitable Home Workshop Job." The response was exceptional both in the number of letters received and their generally high standard of excellence.

The winners are as follows:

First Prize, \$25, Theodore F. Geltz, Massillon, Ohio

Second Prize, \$10, R. L. Hankinson, Dayton, Ohio

Third Prize, \$5, P. A. Whear, Rock Island, Tex.

Ten Prizes, \$1 each: Gordon Holford, Gladstone, N. M.; J. E. Swanger, Santa Ana, Calif.; A. P. Duncan, New West-



First-prize winner installed a heating plant

minster, B. C., Canada; John Mitchell, Point Pleasant, N. J.; Edward B. Smith, Mullen, Tex.; Kelley Lewis, Longmont, Colo.; Harry P. Botsford, Portland, Oreg.; H. Caldwell, Toronto, Ont., Canada; D. H. Frew, Lisbon, Ohio, and M. L. Brooks, Tonkawa, Okla.

Honorable Mention J. G. Pratt, Washington, D. C.; Russell E. Oakes, Waukegan, Wis.; B. E. Foster, Lakewood, Ohio; F. A. Cuffill, Hantsport, N. S., Canada; L. M. Evans, Haigler, Nebr.; James G. Walsh, Dunmore, Pa.; J. S. Dayer, Bombay, India; J. H. Dorn, Dresden, Ohio; H. D. Smith, Nyack, N. Y.; Mrs. J. M. Drane, Louisville, Ky.; David B. Hendrix, Byington, Tenn.; Alex. C. Fabris, San Antonio, Tex., and E. F. Matheson, Utica, N. Y.

The first, second, and third prize-winning letters follow

### Installing a Heating Plant

By THEODORE F. GELTZ

Massillon, Ohio

#### First Prize

**TO** ECONOMIZE when building 10 years ago, we chose a hot-air heater, but soon learned that a change was desirable. Four years ago an opportunity

(Continued on page 116)

## PRACTICAL BOOKS

THAT WILL

## RAISE YOUR PAY

**WRITTEN** in easy-to-understand non-technical language these books will help you in your chosen trade. Every book is an entire course of instruction condensed into one volume. Thousands of men have used them to increase their pay. You will find them full of information and ideas that will help you raise your pay.

### Painting and Decorating

Best Crane Book of Home Furnishing and Decoration	Cloth	\$3.00
House Painting Methods with the High and Spray Gun, by Vanderwalker	Cloth	\$2.00
Interior Wall Decoration, by Vanderwalker	Leatherette	\$4.00
The Mixing of Colors and Paints, by Vanderwalker	Cloth	\$2.00
A New Art of Painting, by Atkinson	Cloth	\$4.00
Strong's Book of Designs	Leatherette	\$4.00
Modern Painter's Encyclopedia	Cloth	\$2.00
Automobile Painting	Cloth	\$1.50
New Hardwood Finishing	Cloth	\$1.50

### Steam Engineering

Swing's Handbook for Steam Engineering and Electricians	Leatherette	\$4.00
Examination Questions and Answers for Marine and Stationary Engineers	Leatherette	\$2.00
Steam Rules	Leatherette	\$2.00
Boiler & Catechism of Steam, Gas and Electrical Engineering	Leatherette	\$1.50

### Carpentry Books

Cloth Binding	
Modern Carpentry 2 vols.	\$3.00
The Steel Square 2 vols.	\$3.00
Modern Estimator	\$1.50
Timber Framing	\$2.00
Builder's Architectural Drawing	\$2.00
Concrete	\$1.50
Practical Bunglowers	\$1.00
Roof Framing, by Van Linschoten	\$1.50

### Electrical Books

Telephony, Including Automatic Switching, by Smith, 450 pp.	Leatherette	\$2.50
Practical Applied Electricity	Cloth	\$3.00
Wire Diagrams and Descriptions	Cloth	\$1.50
Armature and Magnet Winding	Cloth	\$1.50
Electric Motors, D. & A.	Cloth	\$1.50

## CHECK

—the books you want and mail today with your remittance.

We will send you the books you order on our guarantee that if you are not thoroughly satisfied with them we will return your money.

POPULAR SCIENCE MONTHLY  
250 Fourth Avenue  
New York

### POPULAR SCIENCE MONTHLY

Gentlemen:

Please send me the books I have checked for which I enclose my remittance of \$\_\_\_\_\_. I am ordering these books on the basis that if I am not satisfied my money will be refunded.

Name \_\_\_\_\_

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# The UTAH line

Trade Mark Registered  
Made in Salt Lake City

## SPEAKS FOR ITSELF

MADE OF HARD RUBBER

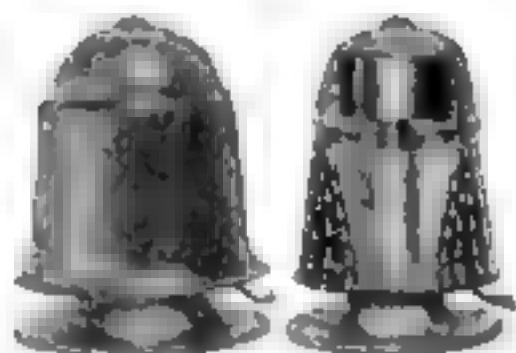
### The guaranteed loud speaker

Utah's supreme loud speaker. We say it to be the best manufactured in the United States today.

Ask the man who has one.

We are manufacturers—not assemblers.

Make the Utah booth your headquarters while at the World's Fair Radio Show, New York, Sept. 15-19 and in Chicago at Fourth Annual Exposition Nov. 17-22.



THE UTAH SUPER FLEX. The Super-Flex has a tone chamber equal to that of the usual horn type. Stands by 8 1/2 inches high by 6 wide. Finished in a harmonious brown. Weight 1 pound.

Price \$14.00



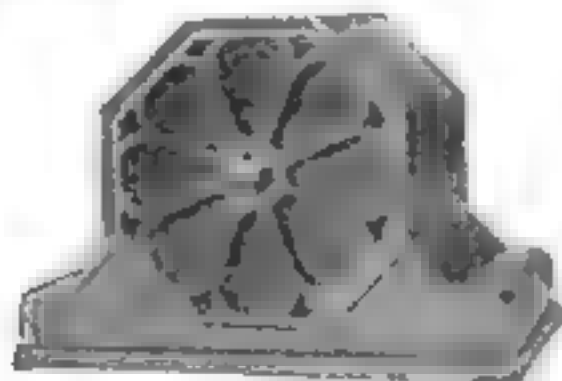
#### GUARANTEE

Buy a Utah and use it for two weeks. Compare its tone with the best the others are able to produce. If the Utah does not give better reception return it to your dealer and he will refund your money.



THE UTAH STANDARD. Here is finished in rich varnished black. Museum has her finish. 14 inch bell. Weight 1 1/2 pounds.

Price \$25.00



THE UTAH SUPREME. Finished in a soft antique mahogany, designed to please both eye and ear. Measures 10 1/2 x 8 x 7 1/2. Weight 8 pounds.

Price \$25.00



THE UTAH PHONOSPEAKER. Handsomely finished in black rubber. Furnished with stand to rest on turntable of talking machine, or without.

Price with Stand \$10.00

Without Stand \$7.50

**UTAH RADIO PRODUCTS COMPANY**

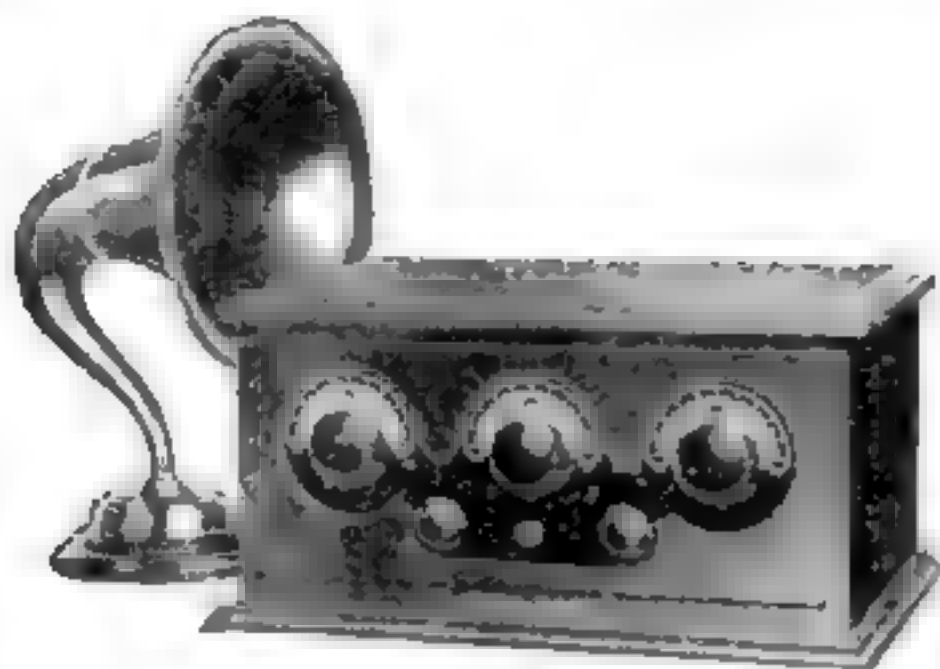
Dept. 516

1427 S. Michigan Avenue

Chicago, Illinois







## ANNOUNCEMENT

This is of interest to opera-goers, to lecture and symphony patrons as well as to the dancing set, and to those scientifically interested.

Artistic radio has come with Thorola Isodyne, embodying the *Isolated Power* principle made possible only by Thorola Low-Loss Doughnut Coils. They conquer "pick-up" of unwanted stations, waste of power, uncontrollable "oscillation," freak wiring, uncertain operation. Radio experimenters know what all this means. Radio listeners no longer need to know!

With Isodyne action any one station wanted is cleanly selected, even in broadcasting centers. Utmost power is *isolated—focused*—on this one set of signals only. The delicate radio impulses do not conflict, neutralize, offset each other. Full tone, unmodified—full volume, full distance at last are possible, at all wave lengths.

With temperamental factors banished, Thorola Isodyne achieves uniform reception. The same stations keep coming in the same. The set your dealer demonstrates tells what your set will do.

Radio reception is unmistakably elevated. There is a complete Thorola receiver leading its field by far, just as Thorola excels in loud speakers and apparatus.

The Thorola name is surety of radio development not to be eclipsed. The intense interest in the 5-tube Thorola Isodyne at every radio store will tell you where expert opinion centers today. Go and listen.

REICHMANN COMPANY, CHICAGO

# Thorola

ISLODYNE

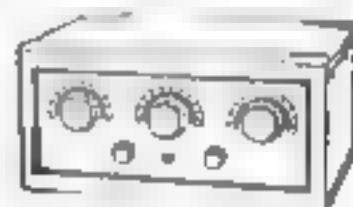


Thorola Loud Speakers with new improved Bakelite horns and grid thrust-band are even better in appearance and performance.



Thorola Low-Loss Doughnut Coils installed in your present set will give you many of the greatest Thorola advantages.

Thorola 4.....\$25 Complete set (3) \$12  
Thorola Jr.....\$15 Per coil.....\$4



The very proportions of Thorola Cabinets suggest new internal design.

In many Thorola Cabinets \$85 the 5-tube Thorola Isodyne is

In winning Harlow Walnut Cabinet with speaker top or \$115 5-tube Thorola Isodyne is



## Gauging the Good in New Machines

Can you see the good in new machines and show up their possibilities? Can you gauge what they're good for, production-wise?

Veeder Counters rate machines by the actual figures on production-rate.

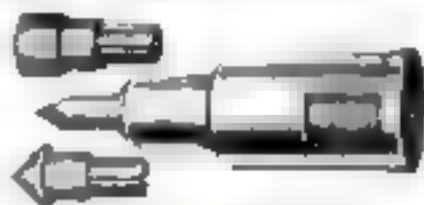
Here's your proof of work-capacity, and pointer to greater capacity. Each new step toward a better machine counts for what it's worth on your

## Veeder COUNTER

The small Revolution Counter below registers one for a revolution of shaft recording a machine operation or product. Though small, this counter is very durable; its mechanism will

stand a very high rate of speed making it especially suitable for light fast running machines and most adaptable to experimental work. If run backward the counter subtracts. Price \$2.00. (Cat 4-5 H.M.) Small Rotary Ratchet Counter, to register reciprocating movements of small machines, also \$2.00

Here's the handiest instrument for finding revolutions-per-minute of a shaft or flywheel. You hold the tip of the counter against end of revolving shaft press lightly when the second hand of your watch comes to 0—release pressure when minute is up. A spring clutch controls the recording mechanism.



Cut less than 1/2 size

The Veeder Speed Counter enables you to keep motors, engines, generators, line shafting and machines operating at efficient speeds. Price, with two rubber tips, (as illustrated) \$3.50

**FREE:** The 80-page Veeder booklet of Counters, to help in your development-work.

**The Veeder Mfg. Co.**  
44 Sargeant St., Hartford, Conn.

## Profitable Job Contest

(Continued from page 110)

price of furniture was at its peak. The need for action arose when my wife desired some new furniture for her guestroom.

With an order for a mahogany bed on my book, I started my furniture factory in the basement of our home. My equipment comprised a workbench and a few hand tools. The plans consisted of an illustration cut from an advertisement.

I went to a dealer in second-hand building material and secured enough mahogany to make the bed. Some of it was so black and dirty it was scarcely recognizable. The cost of the lumber, cut to rough dimensions and delivered at my home, was \$1.75. The cost of stain and varnish made the total cost of material for the bed approximately \$3.50. The scrollwork was done on a small jig-saw, which I had owned since boyhood.

The spinet desk to match the bed, I considered a more difficult job, and for this reason I made a full-sized layout on paper. I purchased new mahogany for it at a cost of \$6.50. Other extras cost about \$1.

On figuring up the results, I found that I had converted material costing approximately \$11 into furniture that, if purchased, would have cost at least \$125.

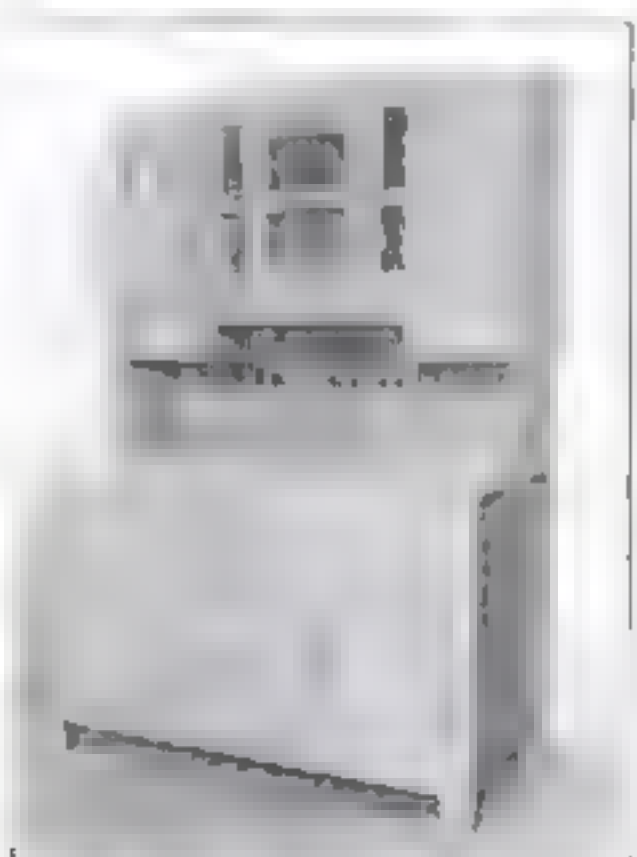
## Enameled Kitchen Cabinet

By P. A. WHEAR

Rock Island, Tex.

Third Prize

WHILE carpentry is not my line of business, I take great pleasure in making different pieces of furniture for the home in what spare time I can find. So the department that interests me



Home Workshop Blueprint No. 5 was used by P. A. Whear in making this kitchen cabinet

most in your monthly is the Home Workshop. I have made quite a few pieces

(Continued on page 110)

## An Easily Made Smoking Cabinet

EVERY man who works with tools—whether he is a novice or a "handyman" with long experience—will find it easy to build this handsome smoking cabinet.

Space for cigars, cigarettes, match boxes, cigar and cigarette holders and pipe cleaners are provided. A feature that every smoker—and his wife—will appreciate is the ash trays which are removable at both ends of the cabinet. When not in use these ash receptacles can be closed.

Blueprint, including full details for making this handsome smoking cabinet, can be secured by sending 2 cts.

## Popular Science Monthly

250 Fourth Ave.

New York



## SALESMEN-You

Have Wished for This  
NEW BIG MONEY MAKER

PHOTO MAKING CO. Inc.  
214 Madison St. Chicago, Ill.

## SPORT BODIES 34.95

CENTRAL AUTO SUPPLY CO. Inc.  
1000 N. Dearborn St. Chicago, Ill.

RANDOLPH RADIO CORP.  
1501 UNION AV. CHICAGO, ILL.

## The Real Estate Educator

This book gives a most comprehensive set of most complete arrangement of period facts about buying, selling, leasing and subleasing of Real Estate, including for election or return, mortgages, insuring, etc. Cloth, 256 pages. Price \$2.00, post paid. Popular Science Monthly, 250 Fourth Avenue, New York City.

# ANNOUNCING

## the



## new

# RATHBUN

## STRAIGHT LINE FREQUENCY CONVERTER

**T**HE modern radio receiver has abundant tone, volume and power—now it may have *perfect, simplified control.*

The Rathbun Straight Line Frequency Converter is adapted for use on your receiver—every receiver—without change of equipment—except the condenser dials. Each station is given

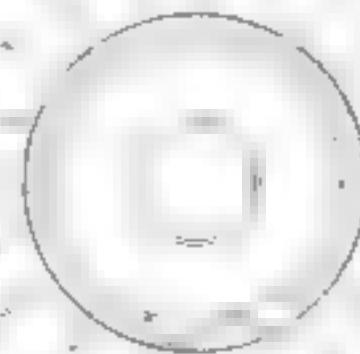
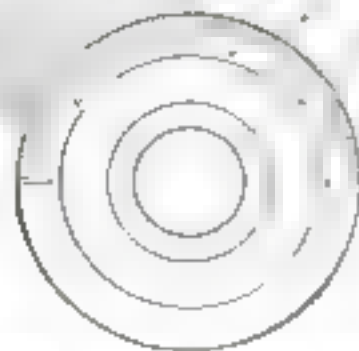
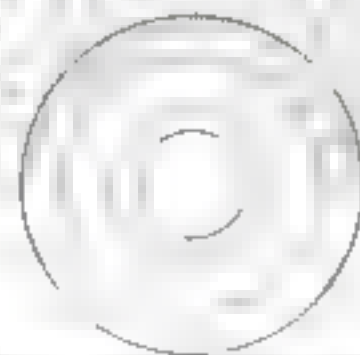
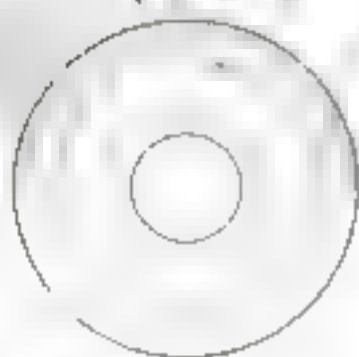
a distinct reading at a uniform distance from the next. Real logging becomes a fact. The stations are distributed with flawless precision over  $360^\circ$ —one complete revolution of the Dial. There is no limitation or crowding as on controls using only half a dial. Radio control is simplified.

The Rathbun Straight Line Frequency Converter provides straight line frequency tuning with ordinary capacity condensers. It is interchangeable with any dial—on any receiver. It is sold with the guarantee of reliability and satisfaction attached to all Rathbun Radio Apparatus.

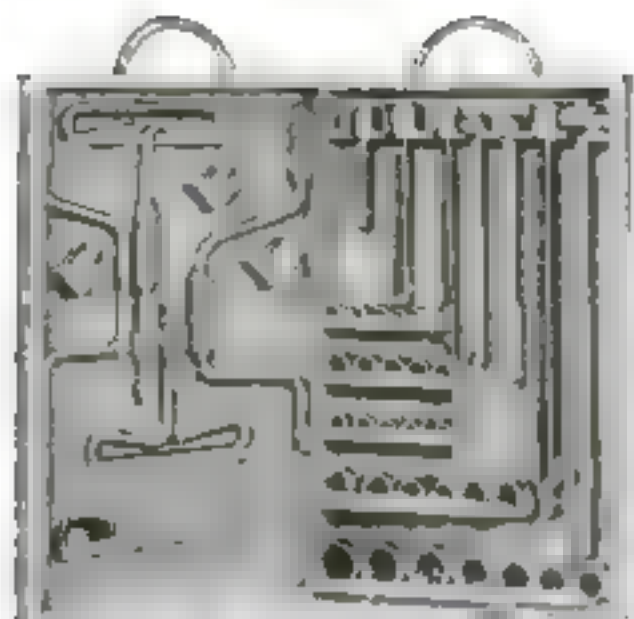
See and Try it—at Your Dealer's

If your dealer cannot supply you, send Money Order \$3.50 each, and your order will be shipped promptly by Parcel Post prepaid.

Rathbun Manufacturing Co., Inc.  
Jamestown New York







The favorite Snap-On Set in garages, factories, power plants and wherever else there is wrench work to do.

9  
Times Out  
of 10

When you go to a garage for repairs on your car, the mechanic works on it with genuine Snap-On Wrenches.

That gives you an idea of the almost universal preference of these fine tools by expert automobile repairmen.

## If You Are Particular About Your Car . . .

If you want to keep it running like new for a long, long time, don't wait for serious trouble. You can buy a little set of Snap-On Wrenches for a small sum that is designed especially for work on your car alone and it will make it so astonishingly easy for you to keep all the nuts and bolts properly tightened up that you will never let your car get badly out of fix. With your Snap-On Set you can prevent road trouble and save the time and expense of being towed in. Use genuine Snap-Ons like the experts use. Look for the name Snap-On on each handle and socket. It is not a genuine Snap-On without the name.

**Snap-on**  
INTERCHANGEABLE  
Socket Wrenches  
**SNAP-ON WRENCH CO., MFRS.**  
Milwaukee, Wisconsin  
**Motor Tool Specialty Co.,**  
14 E. Jackson Blvd., CHICAGO

Gentlemen,  
Please send particulars about Snap-On Set for  
Mechanics Set, check here  
I buy tools from  
Name  
Address

## The Home Workshop

### Profitable Job Contest

(Continued from page 118)

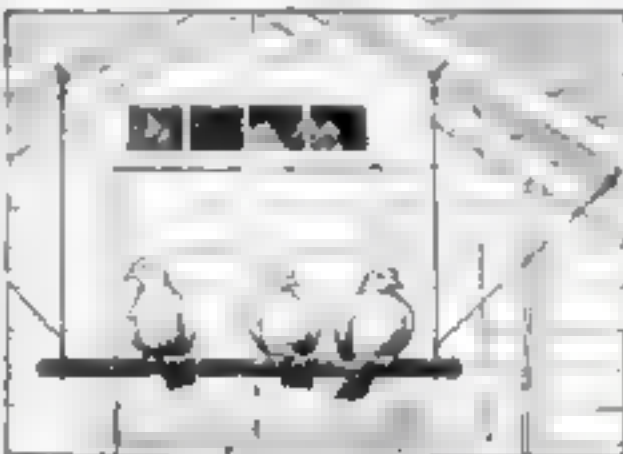
illustrated in it and have sold some of them.

The most profitable one was a kitchen cabinet, built from your Blueprint No. 5. I did not follow your directions exactly, but got the main idea from the blueprint. A cabinet like the one I made costs about \$65 to buy; it cost me for material \$25.53, so that I figure I saved at least \$35 by making the cabinet myself. In addition I made a second cabinet and sold it at \$25 profit, making me a profit of \$60 on the two cabinets.

It took me a month to make the last cabinet, working at it only in the evenings after six o'clock. The tools used were hammer, saw, square, and a large and small plane. The dimensions were 71 by 48 by 26 1/4 in. The cost was as follows: Glass knobs, \$1.20; wood screws, 60 cts.; 2 qts. paint, \$1.50; 2 qts. enamel, \$2.40; corner braces, 30 cts.; latch, 20 cts.; elbow catch, 6 cts.; sandpaper, 25 cts.; hinges, 46 cts.; blacksmith, 60 cts.; oilcloth, 60 cts.; nails, 25 cts.; express, \$1.99; postage, 24 cts.; lumber, \$9.50; flourbin, \$2.80; glass, 60 cts.; glides, 10 cts.; lock, 25 cts.

THE entries in this contest revealed an almost incredible range of home workshop activities. The tabulated list of projects ranges all the way from awnings, bathtubs and beds, to tea wagons, trellises and wells.

### Ratproof Pigeon Perch



IN PREVENTING the disheartening destruction of pigeons by rats, the perch illustrated above has proved effective. It is simply a wooden pole or broom handle suspended in midair by wire. Braces of fine wire are used at each end to prevent the perch from swinging.—C. M. Wilcox

### Pipe Wrench Used as Vise

FEW things are more awkward than to have to do any work with pipe when no vise is at hand. In such an emergency, a pipe-vise may be improvised by nailing or clamping a pipe wrench of the steel handle type on the workbench or any convenient place.

In one instance a heavy pipe wrench was bolted to a repair truck



For holding pipe

# Stop Wasting Coal!

Use less coal—get more heat—haul fewer ashes—stop extra trips to "fire up"—have your home warm and balmy—**SAVE MONEY** by stopping your fuel dollars from going up the flue. Make your heating plant **MORE EFFICIENT** with the

## CROWN Fuel Saver



A silent fire device, easily installed on furnace door, which mixes a supply of super-heated air (oxygen) with the gases over the fuel bed.

It raises many heat units which would otherwise be drawn up the flue. Brings the fire to the top of the bed of coals where it does the most good. Warranted to save 20% of coal bill—often saves much more. Successfully used for 10 years.

### Write for Description

A detailed description of the CROWN—its scientific principle—application—and splendid results—has just been issued. Write for it, especially if you buy coal for home, school, theatre, church or greenhouse. You can use cheaper low grade fuels with great success.

**Distributors Wanted** A wonderful sales proposition and exclusive territory for a few more live distributors. **WRITE TODAY**—ask if your locality is open.

**CROWN FUEL SAVER CO.**

110 N. Tenth St., Richmond, Ind.



Day and Nighttime protection for your tools provided by

**Gerstner Tool Cases** for MACHINISTS and TOOLMAKERS

See Per. Catalog  
**H. GERSTNER & SONS**  
572 Columbia St., Doris, O.

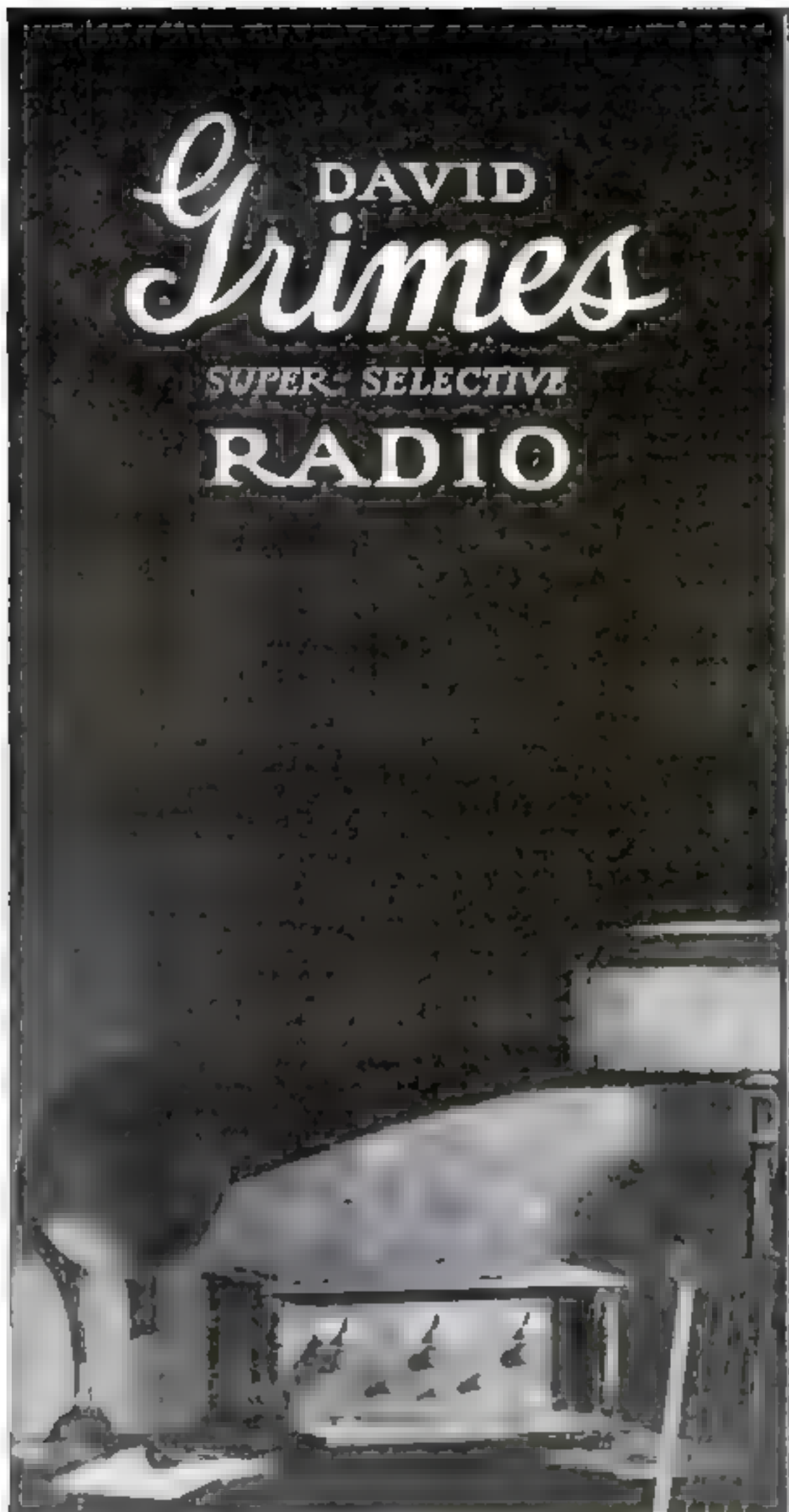
**1926 CATALOG JUST OUT!**  
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**RANDOLPH RADIO CORP.**  
100 N. Union St., Chicago, Ill.

**"LIGHTING FIXTURES"**  
Ready to hang  
Direct from the manufacturer  
Complete wiring including  
New fixtures and supplies  
Special proposition—**ERIE FIXTURE SUPPLY CO.**  
Desk A. Erie, Pa.

**DUPLICOPY**  
EASY TO OPERATE—HEAT AND FAST  
**AGENTS WANTED**  
DUPLICOPY Mfg. Co., 828 Jackson St., San Francisco, Cal.

# DAVID Grimes

## SUPER-SELECTIVE RADIO

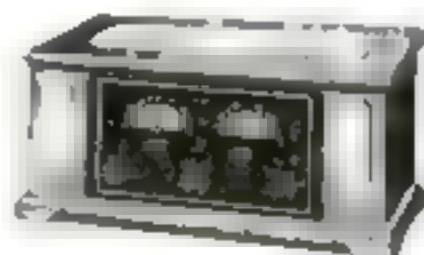


## More Stations On the Air

**Y**OU'LL want to hear them all—but one at a time. The Grimes Circuit in the Grimes Inverse Duplex receiver will give you the sharp tuning desired. Greater volume, distance range and a tonal quality you've never heard before are also yours in this remarkable instrument.

Dual operation of the tubes, providing two stages of radio frequency, vacuum tube detector and three stages of audio frequency amplification, gives you the energy of a six tube set with the economy of four tubes. A super power switch gives tremendous reserve power for distant stations.

A new form of inductance—the twin cylinder coils and straight line condensers allows you to tune in the desired programs and shut out the rest.



**BABY GRAND Duplex Model,** using 3 tubes with the power of 4 tubes. In two-tone mahogany cabinet, housing all batteries.

(Without Accessories) **\$49.50**  
West of Mississippi \$60



**EMPIRE MODEL,** in reality a 6 tube set operating on 4 tubes. Enclosed in 17th Century Solid Mahogany French Cabinet, housing all batteries.

(Without Accessories) **\$125**

Products of  
**David Grimes Radio  
& Cameo Record  
Corporation**

1571 Broadway, New York, N.Y.

David Grimes  
Super Tone  
**LOUD SPEAKER**  
with a mica diaphragm  
that eliminates  
distortion. **\$25**



**ITALIAN RENAISSANCE MODEL**  
Using 4 tubes with the power of 6  
tubes. Built in mahogany cabinet of  
two-tone Mahogany. **\$125**  
Housing all batteries.  
(Without Accessories)

Ask a Grimes Dealer for Demonstration



## "ATKINS"

Always Means  
Quicker, Easier  
Metal Cutting!

**YOU**—whenever and wherever you cut metal—can save time and money by using genuine Atkins "Tungsten Alloy" Hack Saw Blades.

The Atkins Hack Saw Chart—free—tells the right Atkins blade for every metal cutting job to save you time, money and material.

The name ATKINS on the blade means the highest grade "Tungsten Alloy" steels, chosen by the great Atkins laboratories, tempered by the exclusive Atkins gas and oil process, "file tested" to prevent breakage and insure extra life and value.

Ask YOUR Hardware Dealer for genuine ATKINS "Tungsten Alloy AAA" Hack Saw Blades. All Hard or "Non Breakable." We'll gladly send you the Atkins Hack Saw Chart and our valuable booklet "Atkins Saws In The Shop."

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ALLOY SAWS

## Home Workshop

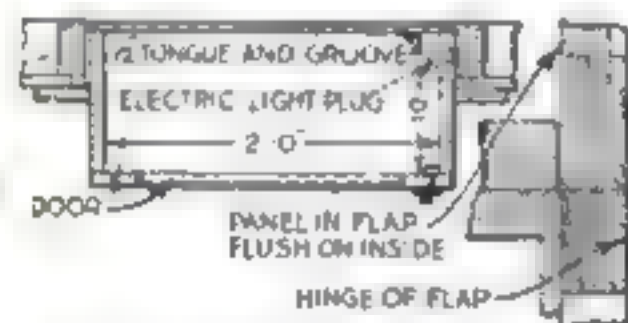
### Sewing-Machine Cabinet Built into Wall

By A. May Holaday

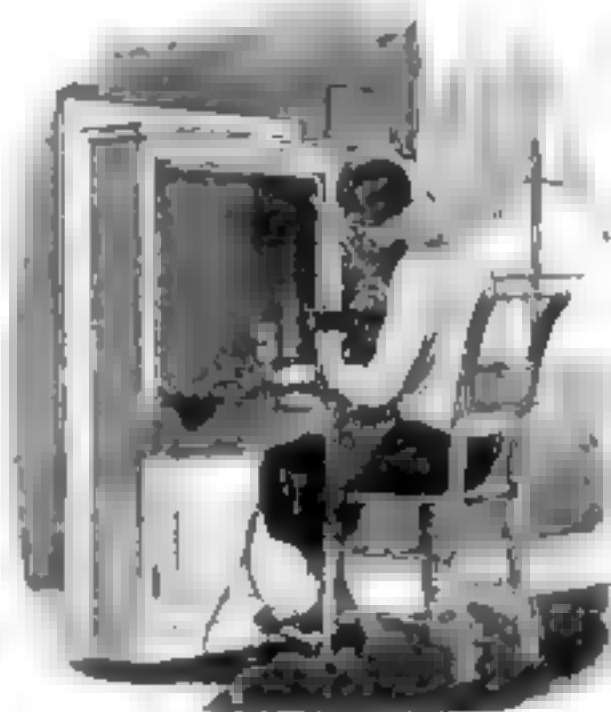
**I**N THE modern space-saving apartment the old-fashioned sewing-machine has been supplanted by the small electric portable. A convenient place for the electric sewing-machine is seen in this sewing-cabinet set into the wall close to a window.

The opening, which is cased all around and provided with two small doors, may be of any desired height and fitted with shelves to suit one's needs. But the shelf holding the electric machine should be set 29 or 30 in. above the floor.

The upper door is a drop-leaf that opens downward to shelf level; it is supported by hinges and two strong chains. The machine is drawn forward



Horizontal section through the cabinet, and detail showing the framing and door construction.



on this handy table and the cord is plugged into an electric outlet inside the cabinet. A dining-room chair is of proper height to use with this table.

Any narrow wall cabinet or china cupboard already built in the house, if 10 in. deep and 2 ft. or more wide, may be converted into a similar sewing-cabinet.

### A Variocoupler of Exceptional Efficiency

**A**T SLIGHT expense any one can make an unusually efficient variocoupler for a radio receiving set. The only outlay will be for a spool of No. 18 double cotton-covered magnet wire for

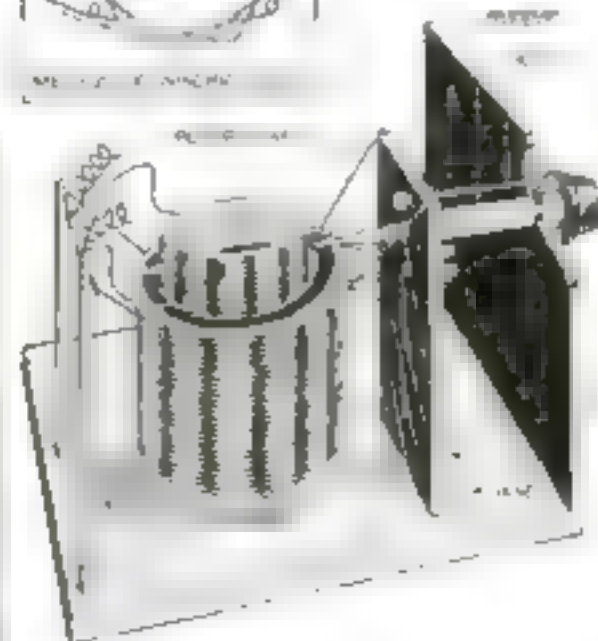
or rotor coil is 2 1/2 in. in diameter and has 40 turns. The turns are bound together with thread, making the coils practically self-supporting.

The rotor shaft, sleeve, and subpanel are wood, although hard rubber or other insulating compositions may be used, if preferred. Holes are drilled in both panels to allow the passage of the shaft. The sleeve is slipped over the rotor shaft and fastened to it with a brad. A threaded rod fastened with a nut at each end is used to draw the subpanel toward the main panel. The proper tension on the rotor shaft is obtained by tightening one of these nuts. The subpanel also is fastened to the base of the set with brads. A knob or dial is fitted to the shaft.

The primary coil is suspended beneath the secondary rotor by strings that are attached to the subpanel and to two supporting posts.—E. L. GOODWIN.



How the coils are wound and the parts assembled. The coils are mounted to reduce all possible electrical losses to a minimum.

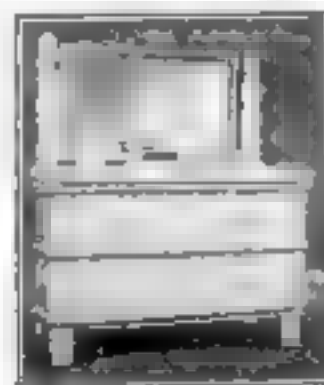


winding the coil, as the other materials usually are to be found about the house.

Winding forms are made by drilling holes in a board and setting pegs as shown. The primary or stationary coil is 4 in. in diameter and has 80 turns tapped at every 20 turns. The secondary

### Toy Dresser Made from Box

**T**HE dresser illustrated, which is 11 by 16 by 23 in., was built from wood taken from an old box and a small mirror. It was given three coats of white paint and one of ivory enamel.—ALBERT HONER.



A doll's dresser that cost little.

## How to Cover Cracked Plaster

(Continued from page 71)

in using only the regular studs already in place, but it certainly is worth while to cut away the plaster and lath for inserting an extra stud where a well formed panel cannot otherwise be obtained.

Having decided the plan of panels on the ceiling and taking into account the width of the decorative strips, strike guiding chalk lines and nail across the joints 1 by 3 in. furring strips (Fig. 1). Preferably these should not be more than 16 in. apart from center to center. Border the edges with 1 by 4 in. strips. With a straight edge try these for alignment with themselves and the rest, driving shingle points under the low places to bring them to a line.

THE wallboard may be cut easily with a fine saw, or by scoring with a knife and breaking off. If one person must put it up alone, make a T support to hold up one end.

Patent clinching fasteners for the fiber boards are to be recommended for use on intermediate furring strips, as they eliminate nail holes in the centers of the panels. If these are not used, nail the centers every 8 in. with 1-in. No. 16 brads, driving the heads nearly flush and countersinking with a nail set. Then nail the edges with No. 16 1 or 1½ in. flat-head nails 10 in. apart, keeping at least ½ in. from the edges. Leave a ¼ in. space between the boards.

If the wall plaster is reasonably straight, apply the board directly, but if it is crooked, nail 1 by 3 in. furring strips to the studding. In either case remove the picture mold, and if furring is used, take up the baseboard as well. This may be used again if pried off carefully. Pull the nails from the back with pliers or cut them off flush rather than pull them from the face; in this way nail holes and probable splintering are avoided. Take off any plate and chair rails, but do not remove the side or head casings of doors and windows. Since the joints between the window aprons and the stools are hidden, it is well to pull off the aprons also. Notch out the back edges of the projecting stool ends, as in Fig. 3, to allow the board to be slipped in behind.

Where no furring is used, locate the studs by tapping the plaster with a hammer, and mark their positions. Stand the board on the base and nail the top with four 2-in. flat-head nails. Strike a white chalk line for the studding and nail the centers with sixpenny finishing nails. Use flat-head nails at the edges, except where they butt against the casings. Fit snugly around all casings.

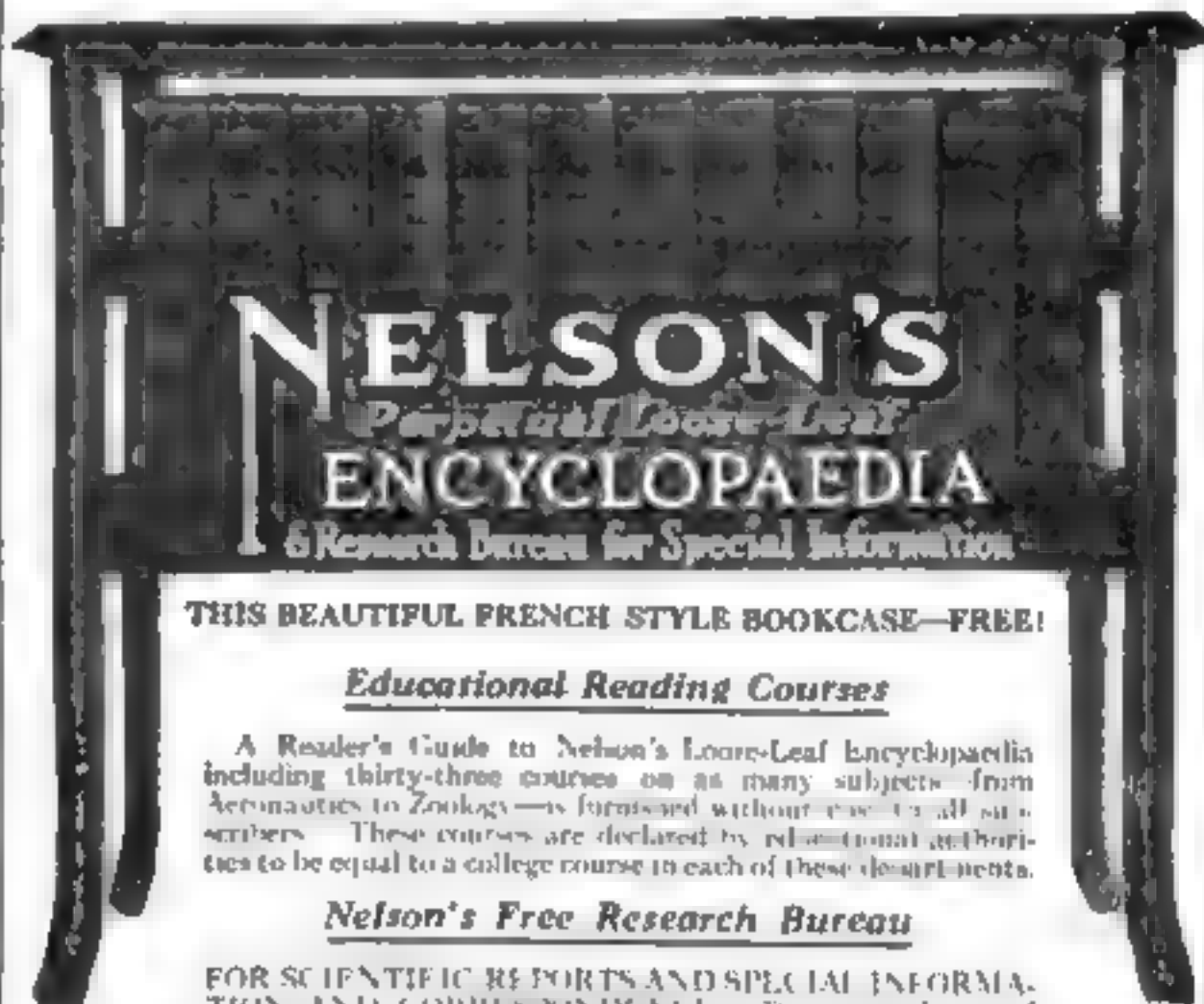
For the average room, decorative strips 2½ in. wide (stuck from stock 3 in. wide) and ½ in. thick are satisfactory. The profiles detailed in Fig. 6 are neat, the third design being the best, though somewhat the hardest to handle. If the plain profile with the rounded corners is used, most of the joints with the cornice and base may be butted. If the edges are

(Continued on page 124)

## Man's Education never Ceases

Education is the process of conquering one's environment. The widening of this circle ends only with life. Every day the world should be made new by some new acquisition of truth. Huxley says—"All education is habit formation." Those who form the Encyclopaedia habit—a few minutes a day with Nelson's—are the educated and progressive men of their day.

JOHN H. FINLEY,  
Editor-in-Chief.



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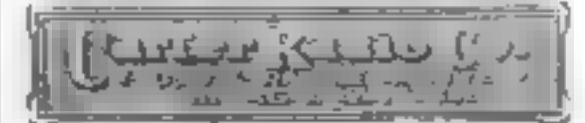


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## The Home Workshop

### How to Cover Cracked Plaster

(Continued from page 123)

molded, joints with the cornice must be made by mitering in the depth of the molded edge and butting the plain width (Fig. 8). Many mills will run special moldings on the strips for a small additional cost for setting up the machine. It is common practice in some sections of the country to use plain panel strips and separate panel moldings, which can be obtained in various styles.

The ceiling member of the cornice, it will be noted, is 1/2 in. wider than the lower wall member, so that the same width will be shown by both pieces when they are in place. Always use, if possible, such widths as will cut without waste from stock sizes.

Put up the ceiling member first, either mitering the corners complete (Fig. 1), or mitering the molded edges and butting the widths as previously explained. Cut the strips to length, measuring them individually for the places they occupy, and mitering back the edges. Tack one end in place while the miters are scribed on the cornice. Then take down and cut out the miters with a chisel, cutting inside the line and trimming straight the butted portions, acting on the assumption that it is easier to cut out a little more wood in fitting than to add to it.

IF THE strips are cut a trifle long, and the ends placed with the centers bowed down, the leverage developed in straightening the piece will go far to close irregularities in the joints. Be very careful, however, to keep these strips straight, and to avoid such pressure in any one that joints in others already nailed up will be opened. Scrape and sandpaper the joints.

Next, run the wall member of the cornice. Butt the upper edge of this member against the ceiling piece, first beveling the edge back from the face to insure a close fit. Put up the two long sides and cope the end pieces between, also springing them into place.

The joints between wallboard and casings now must be hidden. Figure 5 shows desirable forms of back band to run around the casings, but the thickness will vary in each case, according to the thickness of the wallboard.

If the casings are molded and mitered, as in Fig. 3, simply miter the back band around them; but if the ordinary butted casing with neck and cap mold is used, as in Fig. 4, other handling is necessary. Remove the cap mold before applying the wallboard, cut off the projecting ends of the neck mold, and notch the front edge to fit against the lip of the back band. Then miter the band around, and replace the aprons under the windows.

Next, apply the panel mold for the base (Fig. 7), and cut the decorative strips between it and the cornice.

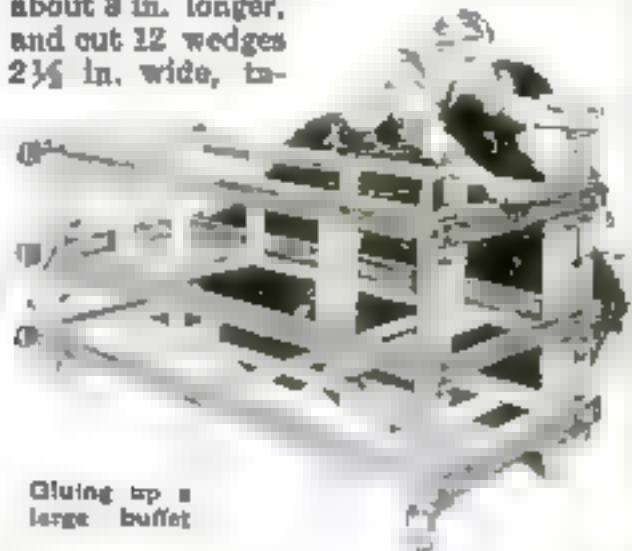
The corner strips are molded on one edge only, one piece being 1/2 in. wider than its mate, so that when butted together on the edge as shown, they will expose equal widths.

(Continued on page 125)



### Short Cabinet Clamps Used for Holding Long Work

WHEN about to glue up a long buffet, I found my cabinetmaker's iron clamps were much too short. I therefore made three strongly mortised hardwood frames  $\frac{1}{2}$  in. wider than the buffet and about 8 in. longer, and cut 12 wedges  $2\frac{1}{2}$  in. wide, to-



Gluing up a large buffet

pering from  $\frac{1}{4}$  to 2 in., as shown in the illustration above.

After the buffet joints had been glued, the frames were placed as shown and supported by the pieces A. The wedges B were inserted as indicated and spacing boards C were placed so as to exert pressure on the wedges of the middle frame. The clamps then were used to squeeze the wedges together and draw the joints tight.—I. H. C.

### How to Cover Cracked Plaster

(Continued from page 124)

If it is necessary to fur the walls, use 1 by 3 in. stock and then apply the board in the same manner as on the plaster. It will be seen that the board projects its thickness outside the ordinary casing. This necessitates the use of a panel mold to cover the joint and the lip in this case clasps over the wallboard instead of the casing. If judgment is used in this, all bungling massiveness in appearance can be avoided.

In the case of a brick or tile house, the walls must be drilled and plugged with wooden cylinders  $\frac{3}{4}$  in. in diameter and  $1\frac{1}{4}$  in. long, to provide nailing for the furring strips. To prevent entrance of moisture, waterproof the walls with asphaltum or some other suitable protective paint.

Fill nail holes with white lead putty made by mixing whiting and white lead in oil, or whiting and the sediment found in paint cans. The panels are best painted with flat colors, except in kitchens or other rooms subjected to moisture. Mix with the first coat one-third of hard drying varnish, or, if the panels are to be papered, give them a priming coat to facilitate removal of paper in later decorating jobs.

Paint or stain the decorative strips very nearly, if not exactly, the same tint as the panels, getting color contrasts through the use of draperies.

Other applications of wallboard will be described in an article, "Home Beautifying with Wallboard," which will be published in an early issue.



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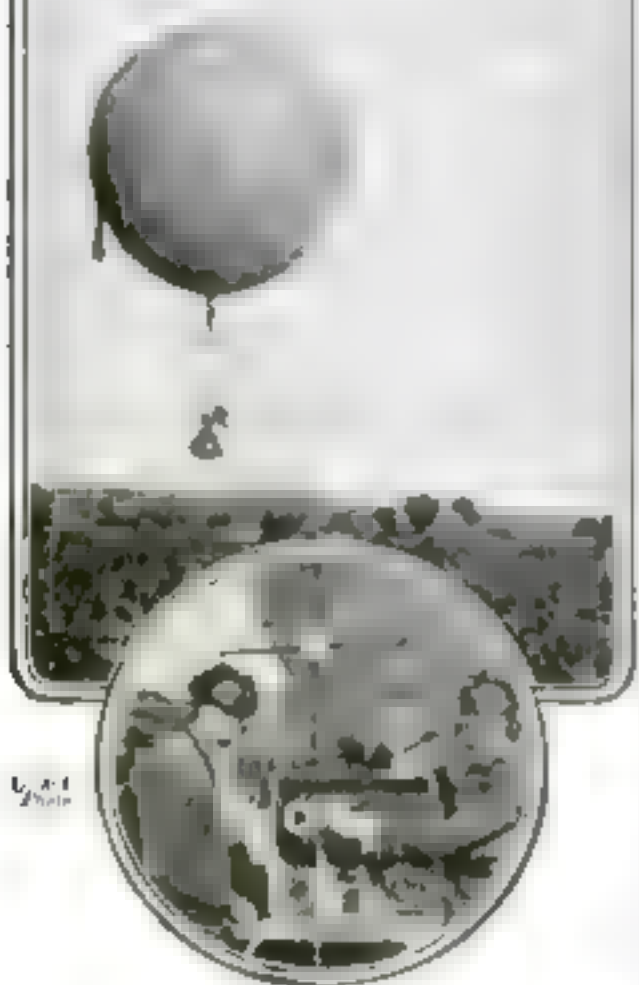
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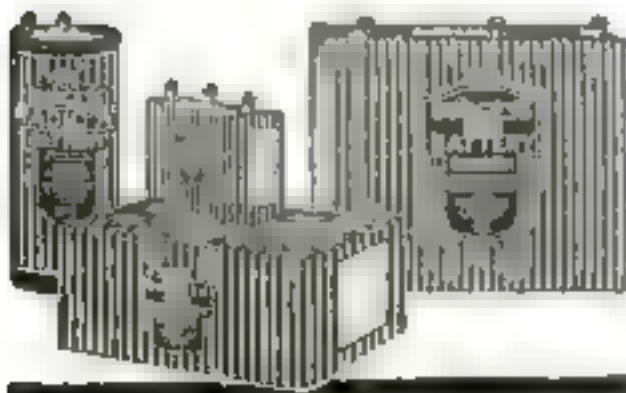
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## Fitting Up an Attic Room

(Continued from page 78)

wedging the jamb) and 6 ft. 7 1/4 in. high (allowing for a 6 ft. 6 in. door with 1/2 in. to spare for leveling the head jamb). If possible, use a regular stud for a side trimmer; but in any event, since the space above is so short, run the trimmer to the ceiling. The door, it will be noted, is located by the hall opening.

Start spacing the studs from the other trimmer or, if the space is small, divide evenly, as shown. This, of course, is not regulation procedure in the case of an ordinary partition of full height; but it is best for such a case as this, particularly when wallboard is to be used. Spike into the head trimmer from the side trimmer with two or three 16-penny common nails, being careful to keep it level. On the backs of the side trimmers nail three blocks to catch the back edges of the door casings, and put blocks at the corners of the room to insure nailing for the base-board ends.

THE other end of the room is built in about the same way, while for the end of the closet the gable studs are used, if such are present.

Figure 7 illustrates the side wall. This is nailed together on the floor and raised afterward, but careful vertical measurements should be made to make certain that, when the upper plate is brought against the under edges of the rafters, the wall will come plumb.

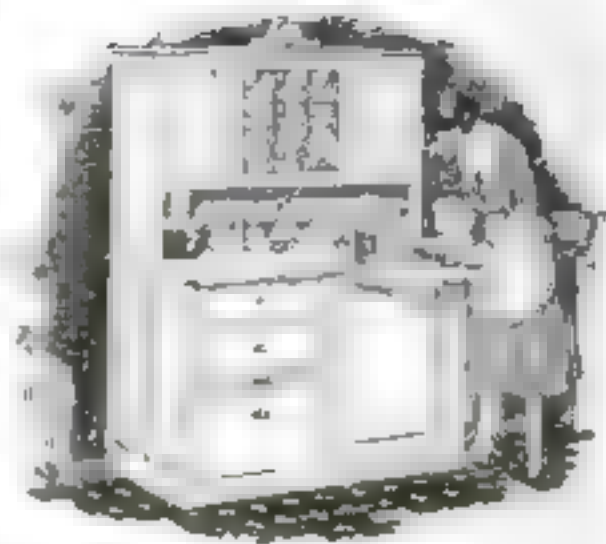
Above the upper plate a space of 2 in. remains, and if the room is to be plastered, blocks must be fitted between the plate above the studs and against headers of 1 by 4 in. boards cut between the rafters, as in Fig. 5. For wallboard, nail in the headers flush with the under edges of the rafters and let them show 2 or 3 in. above the point of intersection of the wall. Fill the space above the plate with a 1 by 4 on edge and notched about the rafters. Fig. 6.

Between the studs of the end walls, following the slope of the rafters, nail pieces of 2 by 4 as backing for the upper edges of the wallboard, as in Fig. 2, and 3 1/4 ft. from the floor cut in fire blocks for additional stiffening. Wherever corners occur, backing must be provided to carry the edges of the wallboard.

Side walls and sometimes end walls should be braced by cutting 2 by 4 in. blocks between studding, as in Fig. 7.

Ceiling joists are placed level at each end wall, the ends butting against the under edges of the false rafters. The others are spiked to the sides of the rafters, and must line with each other. If a straight-edge is nailed to the ends of the end joists, the others can be rested on them and nailed up without further trouble. Bring the rafters to a line if they are of uneven width, by shimming carefully under the narrow ones with thin strips of pine.—E. M. L.

How to continue from this point will be told in the third article of the series in next month's POPULAR SCIENCE MONTHLY.



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# Home Workshop Chemistry

Simple Formulas that Will Save Time and Money



**T**EA SPOONS and other common household units of measuring are used in the Home Workshop Chemistry column whenever possible to simplify the making up of formulas. Judging from letters received from readers, the mere mention of grams and cubic centimeters makes a formula seem complicated. Yet it is a simple matter to convert one measure into another with sufficient accuracy for ordinary purposes.

The proportions are what count in making up a formula. For instance, if ounces are given, the process need not be carried out in ounces; any convenient unit of measurement may be used. The only thing to be considered is that the quantities are reduced or increased in the same proportion throughout.

Here is a table of useful equivalents

1 oz. = 2 tablespoons  
1 teaspoon = 1/2 oz. or 1 dm.  
1 oz. = 28 grams (weight)

If one desires to weigh the chemicals used and no weights are at hand, coins can be used.



Using coins in place of chemist's weights

A half-dollar = 12 1/2 grams  
A quarter = 6 1/4 grams  
A dime = 2 1/2 grams

In avoidance of

A half-dollar = 100 grains A cent = 50 grains  
A quarter = 100 grains A dime = 50 grains  
A nickel = 50 grains 1 cu = 45 1/2 grains  
Therefore, 2 half-dollars (400 grains) and a dime (40 grains) combined are near enough to serve as a 1-oz. weight

If your scales are without a scale bar and it is desired to obtain a weight of, say, 30 grains, place a nickel (50 grs.) in one pan and a penny in the other. Then add the chemical or whatever is to be weighed to the pan holding the cent until a balance is obtained. Any number of combinations can be used in this manner to find intermediate weights.

For average purposes

450 drops = 1 oz. or 30 cubic centimeters  
1 large water-glass holds about 6 fluid oz.  
1 pt. water = 1 lb.

Many almanacs and general handbooks contain tables showing the comparison between the Centigrade and Fahrenheit scales and these can be consulted on the relatively few occasions a question arises.

When it is necessary to convert metric measurements of length into feet and inches, either purchase a rule that has both scales or consult the tables in any general handbook.



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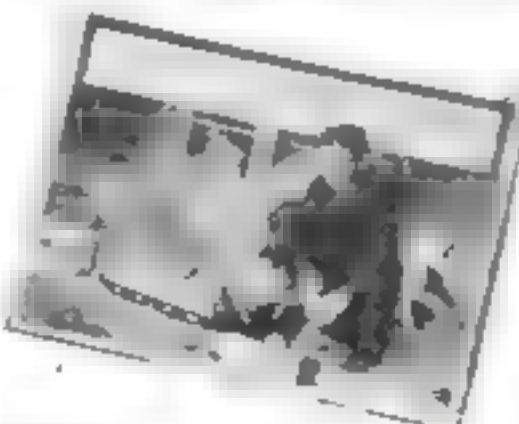
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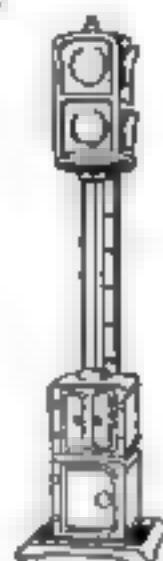
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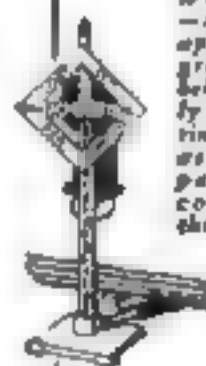
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## The Shipshape Home

### Sawhorse Aids in Repair Work

MANY house-owners endeavor to make the various repairs necessary in keeping their homes shipshape without the aid of a good sawhorse. Yet a sawhorse is an essential for odd jobs as a bench is for cabinetwork. It can be carried wherever needed and used both as a support for work that is to be sawed, planed, chiseled, assembled, or painted, and as a platform on which to stand. For repairs that involve the handling of long boards, doors, full sized window-screens, storm sash and doors, and the like, a pair of sawhorses is desirable.

There are, of course, several types of wooden sawhorses. While few carpenters and, I suppose, fewer amateur woodworkers, are familiar with the design illustrated, it is much better than the



average sawhorse. Every carpenter who has used mine, thereafter has made his own sawhorses like it.

This horse has a double top made of 2 by 4's separated 1 1/2 in. by spreaders. This affords a solid stand for ripping boards. The recesses at each end allow doors or sash to be placed in them for trimming. The wide top gives more foot room when one has to stand on the horse.

The bottoms of the legs, furthermore, are exactly 4 ft. apart lengthwise and 16 in. apart crosswise. The advantage of this, from the viewpoint of a carpenter working on new construction, is that the sawhorse can be placed either way on ordinary joists set 16 in. center to center.

To make the horse requires 2 pieces 2 by 4 by 48 in. for the top; 2 pieces of 2 by 4, 3 1/2 in. long, to serve as the spreaders; 4 pieces 3/4 by 4 1/2 by 26 in., tapered to 2 1/4 in. wide at the bottom, for legs; and 2 end braces, 3/4 by 7 1/2 by 12 in. Any common wood will do, but the parts should be sound, especially the legs.

(Continued on page 129)



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## Shipshape Home

(Continued from page 128)

First the top pieces are mortised to receive the legs. Then the spreaders are nailed in place 4 in. back from each end. The legs next are nailed on; then the braces. Forty-four eightpenny common nails are used.—SAMUEL L. MYERS

### How to Use Aluminum Paint

ALUMINUM paint has many uses in keeping a house shipshape because of its exceptional covering qualities and durability.

One should buy the aluminum bronze powder and varnish separately and mix them as needed. Any good spar varnish makes an acceptable vehicle.

To make aluminum paint, the powder should be added to the varnish in the proportion of 2 lbs. powder to 1 gal. of varnish. This proportion can be obtained by measuring out  $\frac{1}{4}$  pt. powder ( $\frac{5}{16}$  pt. to be exact) in a measuring-cup, pouring it into a container, then measuring 1 pt. of varnish in the same cup and pouring it over the powder. When the powder and varnish have been stirred thoroughly, the paint is ready to apply.

If the varnish is too thick, dilute it with from 10 to 20 per cent turpentine before measuring out and mixing with the powder. Only enough paint for one day's use should be mixed at a time, as the mixed paint will lose its brilliance and hiding power after standing for a few days.

This paint can be used on metal surfaces indoors or out. For outdoor service, however, two coats must be applied to give the necessary resistance to the weather. It will also serve well on wooden surfaces indoors. For outdoor use on wood, the varnish preferably should be diluted with about one-third its volume of boiled linseed oil so as to make a more elastic paint film.

According to experiments made by the Forest Products Laboratory, aluminum paint has a very high waterproofing efficiency. It therefore makes an excellent priming coat for wood. Its high impermeability to moisture keeps wood from cracking, checking, and swelling from absorption of moisture. It serves equally well as a finishing coat.

The more common uses of aluminum paint, such as for finishing radiators, water-pipes, steam-pipes, gas-heaters, furnace exteriors, and the like, are well known, but it is equally valuable on many other surfaces, indoors and out, where unusual protective and covering qualities are required.—JUNIOR D. EDWARDS.

### Protecting Hardware

IN PAINTING woodwork or furniture it pays to remove the hardware if it can be done without much trouble. When this would require too much time, it is well to give the hardware a preliminary coat of vaseline. Any paint that gets on the metal, if allowed to dry thoroughly, can be wiped off bodily with the vaseline.

(Continued on page 130)

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## Shipsshape Home

(Continued from page 128)

### Bracing Eave Troughs

IN MAKING fall repairs to the outside of your house, it is well to examine the eave troughs if they are of the suspended metal type, and make sure that they are rigid enough not to be pulled out of shape and otherwise damaged by ice and snow during the coming winter.

Damage of this kind, which is quite common, can be prevented in most cases by providing additional braces for the eave troughs. If they are of the common type hung with wire hangers, twist a length of copper wire in the outer eye of the hanger, draw it up to the roof and wrap it around a firmly driven nail, then return it and insert again through the eye. Fasten securely, drive the nail home, insert an eightpenny nail in the double wire and twist it until tight. Then remove the nail. Treat each hanger in this way.

If the trough is of a molded type, punch a small hole at the outer edge and proceed as with the half-round style.

If the hangers are of the malleable type and bolted on a copper strap  $\frac{1}{2}$  in. wide with a  $\frac{1}{4}$ -in. hole  $\frac{1}{2}$  in. from one end will serve the same purpose. Insert the hook of the malleable hanger in the  $\frac{1}{4}$ -in. hole, draw the strap up tightly, and nail to the roof.—C W H

### Mice in Pianos

IN MY business as a piano dealer, I have removed hundreds of mice nests from pianos. The repair bills have ranged from \$5 to \$75. Indeed, it is astonishing the damage mice can do in a short time to a costly instrument.

For a long time I tried to find a way to make a piano mouseproof, but every scheme involved too much work or too great expense. Finally it occurred to me to provide the mice with material for a nest so that they would not attack the piano felt. Thus I did at

first by placing in the lower right-hand corner of the piano a hatful of small rags, each about  $\frac{1}{4}$  in. wide and 2 in. long.

That worked well, but later I found a simpler method. When I have the keys off at the time of tuning a piano, I place a folded newspaper under each register or compartment directly under the keys. I have never known a piano to be damaged by mice if either of these plans was adopted.—F X. ALLEN.



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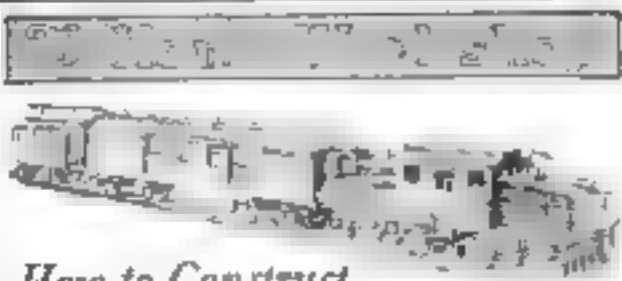
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## How to Construct Couplers for a Model Railroad

By Edward E. de Lancey

**M**AKING model automatic couplers of the old fashioned "Miller" type may impress the average model-maker as an unpromising job, especially as these couplers now are obsolete. The writer, however, has made scores of them and has seldom met with difficulties. They are not apt to become uncoupled on curves, but when they do, the "check chains" always prevent a separation of the train.

As far as "looks" go, they may offend the eye of one who is accustomed to couplers of the Janney type, but that is a trifle compared with the crude appearance of the too widely spaced ears commonly

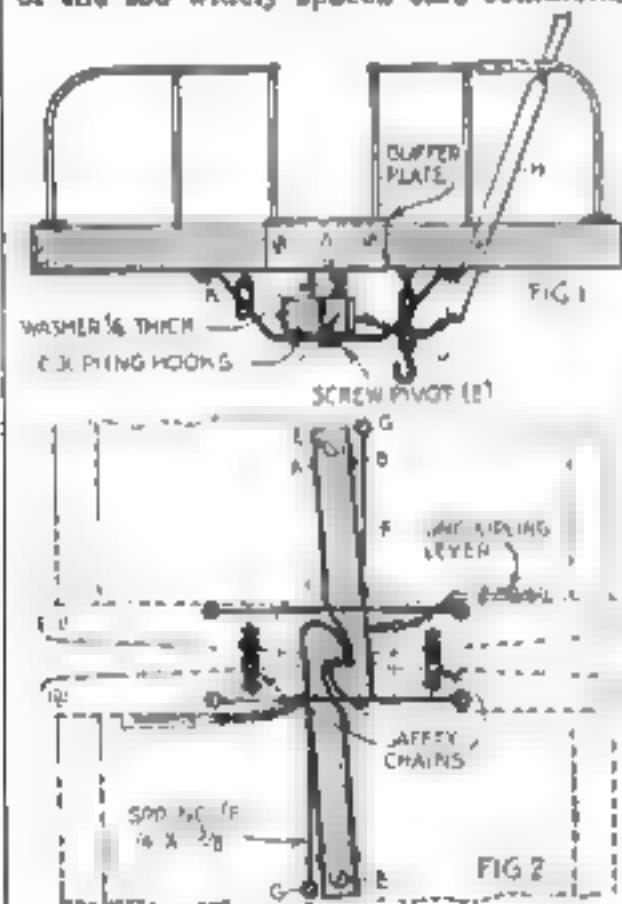


Fig. 1 is an end view of a coupler and Fig. 2 a plan view looking down

met with. Furthermore, there is a gratifying "click" in the way in which a train comes together and couples in one's yards and stations.

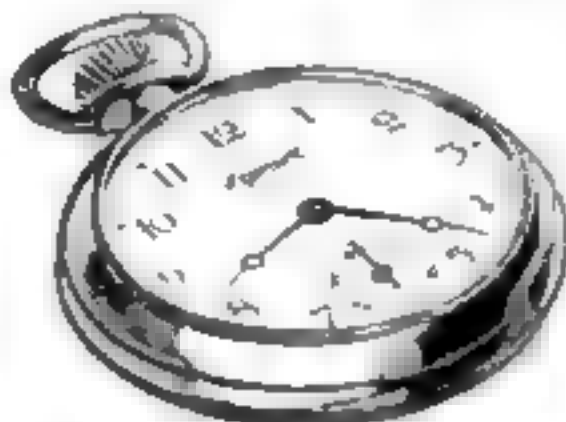
The couplings may be made of  $\frac{3}{8}$  by  $\frac{3}{8}$  by  $2\frac{1}{2}$  in. wooden strips, cut out with a scroll-saw to the shape shown in Fig. 2. These may be of any straight-grained hard wood, but soft pine can be used, provided a  $\frac{3}{8}$ -in. strip of zinc is bound around the sides of the hook and bent so as to conform closely to its contour and fastened by the small brass screws A, B, C, and D.

The hooks must be secured at least  $\frac{1}{8}$  in. below the bottom of the car with No. 5 brass screws (E), 1 in. long.

For locking, a piece of spring brass, (Continued on page 132)

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## The Home Workshop

### Couplers for Model Railroad

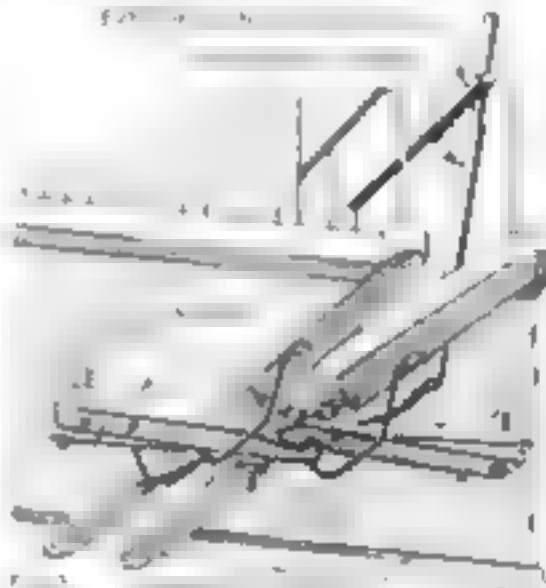
(Continued from page 131)

marked F, is placed behind each hook. It must be curled at one end for the attaching screw, G, and curved a trifle behind the open portion of the hook.

An uncoupling lever (H, Fig. 1) must now be made and pivoted on the left-hand side of the platform, through the slots already provided. A ratchet rack (I, Fig. 2) for holding this lever in any given position, may be made from a scrap of ¼ by 1 in. tin or zinc. One edge should have four or five sloping teeth filed on it. The other side is bent over about ¼ in. and pinched or soldered on the hand rail just above the lever slot.

The buffer plates are sections of ¼ by ½ in. angle brass, 1 in. long, attached over the center of the bumper beam by means of small countersunk screws.

The chains are of two sizes: the first, of small links, not over ¼ in. long, for the uncoupling lever; the second, for the safety chains, with links almost ¼ in. long. Sufficient chain of both kinds can



A pair of zinc-bound wooden couplers as installed under model railway cars

be had from the dealers in model-makers' supplies for a few cents.

The safety chain at the left of each car (J, Fig. 1) consists of a staple, four links, and an open hook. The one on the right (K) consists only of a staple and a link that is somewhat elongated in shape.

Now, with the hook level, ascertain the vertical distance between the top of the rails and the bottom of the hooks. Maintain this distance as a constant in all future cars and locomotives. It will be convenient to make a wooden templet for testing this height.

Attach the short piece of chain to the uncoupling lever, as in Fig. 1, making sure that the safety chain dangles outside the chain of the uncoupling lever. It will be convenient to provide a little hook, made of fine stiff wire, for hooking up the safety chains when the cars are coupled. A very fine buttonhook serves very well. Provide a place on the locomotive for stowing this tool.

In setting the main Miller hooks, leave a good 1/16 in. between the plane of the buffer plate and the plane of the back of the hook. This will allow ¼ in. slack, which will be enough for all ordinary

(Continued on page 133)



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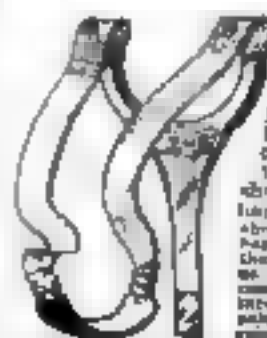
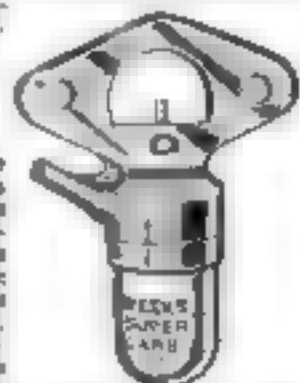
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AUTOMATIC ZIPPER CO.,

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## Couplers for Model Railroad

(Continued from page 132)

curves. In laying your track, try not to make any curves of shorter radius than 6 feet.

The first coat of paint should be merely a priming of white lead with plenty of oil in it. Allow this to become "bone dry" and very hard before applying the color coat. For the color you must choose your own, in accordance with the prototype you have selected. The writer found "Pullman green" satisfactory.

For the striping and lettering it is best to enlist the services of an expert. Nothing can more completely ruin an otherwise satisfactory model than a sloppy, amateurish job of lettering.

**THROUGHOUT** this series of articles, much super-detail has been avoided. If you have been painstaking, you will now find yourself the owner and motor-man of a fast electric locomotive, one which should be capable of hauling from three to five cars at fair speed.

Because of the somewhat complicated motions of each car while entering or leaving curves, it might be a wise precaution to substitute plain flat brim for the angle brim that we have recommended for the buffer plates. If this substitution is made, it will give you an opportunity of bending the buffer plate to match the general curvature of the platform ends, as a whole. This suggestion is made now because for simplicity's sake we have said nothing about placing squelching springs behind the plates.

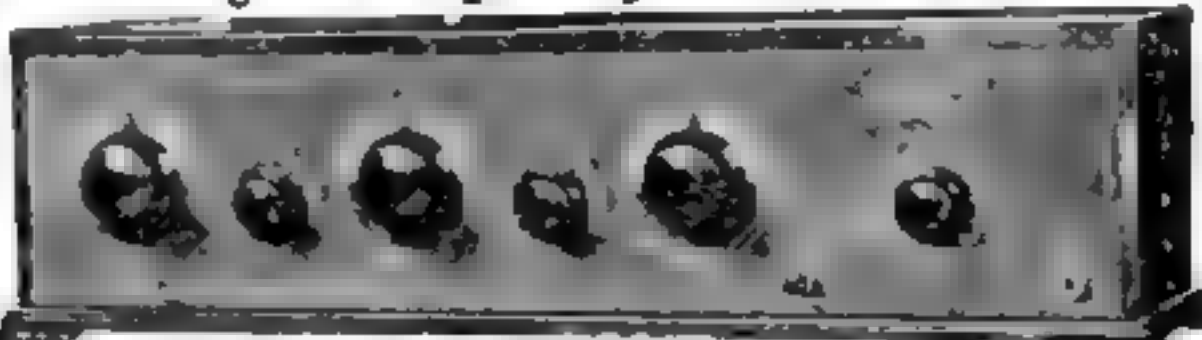
The writer has found that 3/16-in. square steel rod makes a satisfactory and cheap track, but it must be drilled and countersunk for 3/4-in. brads at about 1-ft. intervals. At all points where the third rail crosses the running rails there must be a few inches of "dead" track. This is necessary to prevent a short circuit at the instant the pick-up shoe passes over the running rails. Such a dead track can be provided by inserting running rails of wood, of the same cross section as the steel rails, at the crossing point. About 2 in. will be long enough but they must be located directly opposite the crossing point.

The copper wire that runs along the top of the third rail need not in this case be interfered with. There will be no hesitation or irregularity in the motion of the locomotive at these dead points, because the locomotive has a pick-up shoe on each truck.

Because of serious ill health, the writer is compelled to postpone for the time being all discussion of passenger car and Pullman model construction. This is, therefore, the last article of the present series, which began in the March issue.

In all model work you will find that experience breeds skill. The farther you go, the greater your resourcefulness will become. Cultivate a placid frame of mind and you will find there is practically no limit to the things you can carry through to successful accomplishment. This, in addition to your own gratification, is the great reward of a model engineer.

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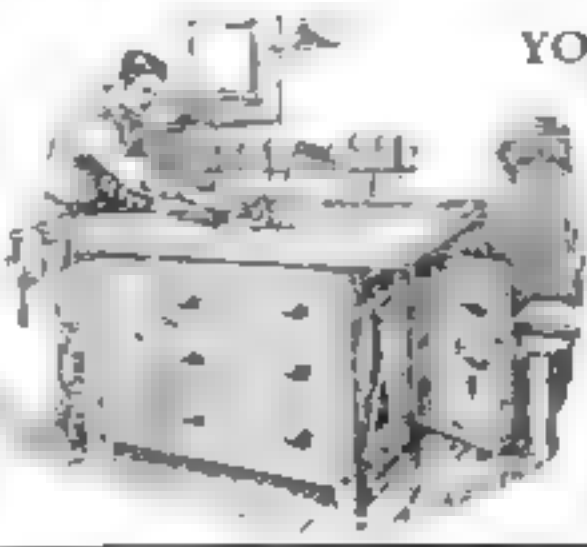
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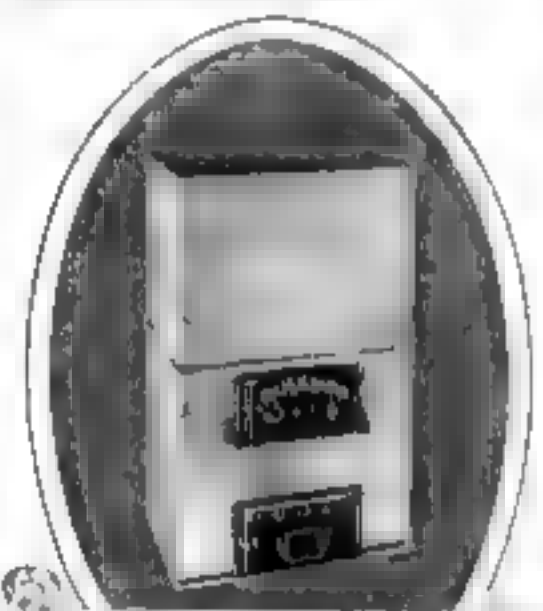


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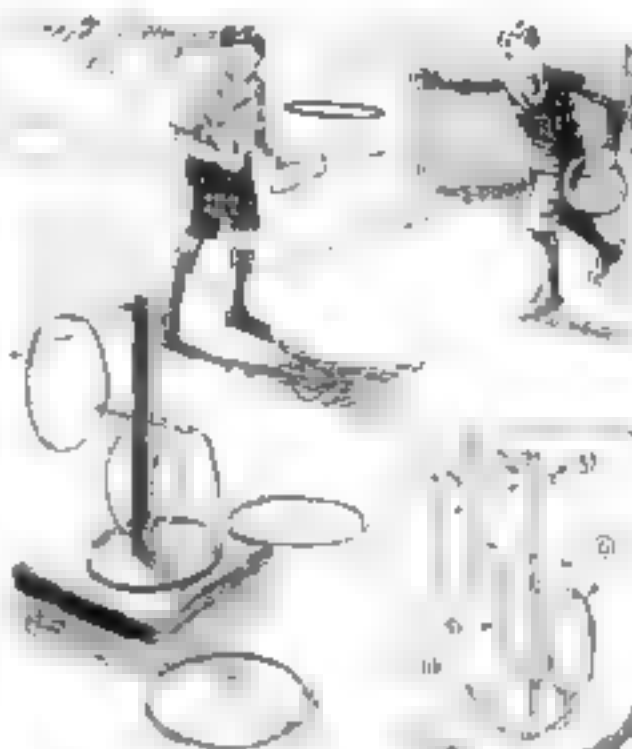
## The Home Workshop

### "Luck-o'-Ring" Is Novel Variation of a Familiar Children's Game

**B**OTH luck and skill are required in the fascinating and novel game illustrated. A stick  $\frac{1}{4}$  by  $\frac{1}{4}$  by 14 in. is screwed to a piece of sheet metal, which is fastened in turn to the wooden base,  $\frac{3}{4}$  by 10 by 10 in.

A piece of spring brass  $\frac{5}{8}$  in. wide is bent and fastened to the top of the standard, as shown, to provide three places upon which a ring can catch. A  $\frac{1}{4}$ -in. dowel 6 in. long is passed through the standard at right angles to the brass piece and about halfway between the top and bottom. The rings are made from 24-in. lengths of  $\frac{1}{4}$ -in. stiff rope, the ends being clamped with thin metal pieces 1 by  $2\frac{1}{4}$  in.

It will be noted that the number of points won by a successful pitch is determined by the position in which the ring lands. If it merely hooks on the dowel, no score is made, but the player receives an extra try. At the end of nine innings, the player having the larger score is the winner. —D. W. C.



The player stands about 15 feet from the post and takes turns pitching their rings. Three rings are colored red and three green.

### Neat Fernery Built on Simple Lines

**T**O BUILD the simple yet attractive fernery illustrated, obtain four pieces of hard wood 1 by 1 by 31 in. for the legs, one piece 1 by 1 by 40 in. for the long and short lower cross bars, and one piece  $\frac{3}{4}$  by 6 in. by 6 ft. for the side and ends. This material must be free from knots and thoroughly seasoned.

The metal parts are five pieces of  $\frac{1}{4}$ -in.-round iron rod 8 in. long, to support the earth box, and a sheet of



galvanized iron approximately 17½ by 34½ in.

In cutting the wood to the correct length, use a meter box as far as possible to insure square joints. Select the pieces with the prettiest grain for the sides and ends that are to be exposed, and sandpaper thoroughly all the surfaces that will be seen.

With a  $\frac{1}{8}$ -in. bit, bore five holes  $\frac{1}{4}$  in. deep on the inside of the side pieces to form sockets for the iron rods. The center of these holes

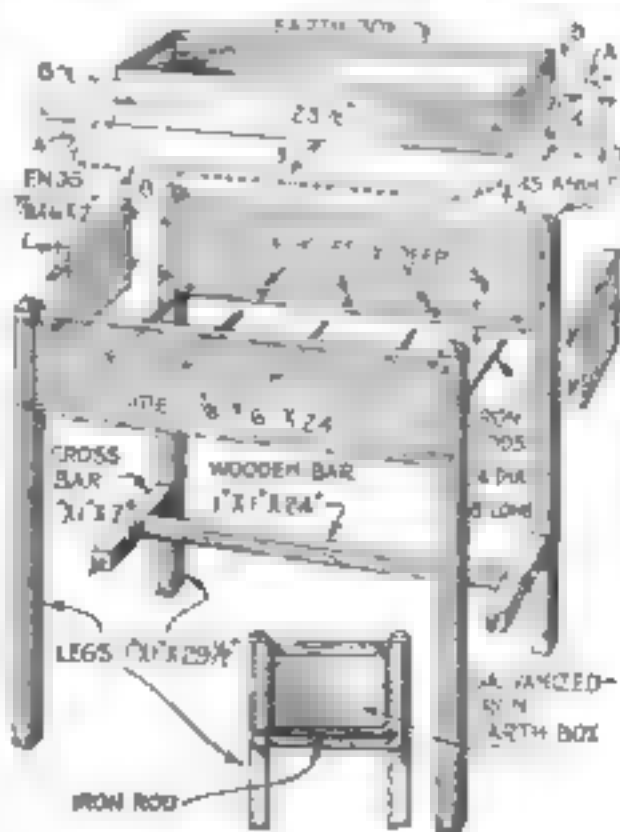
should be  $\frac{3}{4}$  in. from the lower edges.

The assembly requires 22 dowels  $\frac{1}{4}$  by 1¼ in. Bore all the dowel holes, taking care not to center the holes in the legs so that one dowel will strike another.

Put the parts together with hot glue by assembling first the long and short cross bars and then the two sides with the legs. On one of the assembled sides fasten the two ends, then add the assembled cross bar. Place the iron rods in their holes and add the remaining side.

In making the earth box, scribe lines on the galvanized iron, as shown, cut out the piece and bend the four tabs marked A at right angles over a straight-edge. The four tabs marked B should be rolled right over and drawn down tight against the side so as to make a neat rolled edge for the top of the lining. The sides and ends then are bent up with the tabs A inside, and the joints are soldered.

The finishing may be done in any preferred way. A coat of stain, fixed with a thin coat of shellac, and two coats of spar varnish is a desirable finish. —FRANK E. FOX.



How the fernery is put together and method of making the galvanized-iron lining.

## Better Shop Methods

### Old Bill Says—

**K**EEP your tools well shaped and sharp. When a tool gets dull, stop and grind it.

Some men waste a lot of time talking about the imperfections of their tools and machines; they will get ahead faster if they put more thought and energy into the actual doing of the task in hand.

Mill files often will work smoother when rubbed with chalk on both sides after cleaning.

An exceptionally good workman always seems to have an exceptionally good job.

A leather belt always should be run with the hair or grain side toward the pulley; the belt is less apt to crack, will last longer, and will transmit more power.

A medium soft wheel is best for sharpening a milling cutter.

Never bite off too much at one time—go slowly but surely.

Being slow and sure is different from just being slow.

No horseplay in the shop! Too many men have been made cripples by playing around the machines.

It sounds better to hear a man say "I did" than "I'm going to."

### How to Drill Small Bushings, Pulleys, and Gear Blanks

**I**N MAKING bushings, pulleys, and gear blanks from iron, brass, or bronze castings, nothing is to be gained by having the hole cored if its diameter is 1 in. or less. The more satisfactory way is to have the castings made solid. A drill will cut cleanly through the solid metal without as frequent regrinding as if it were biting into a rough, cored opening.



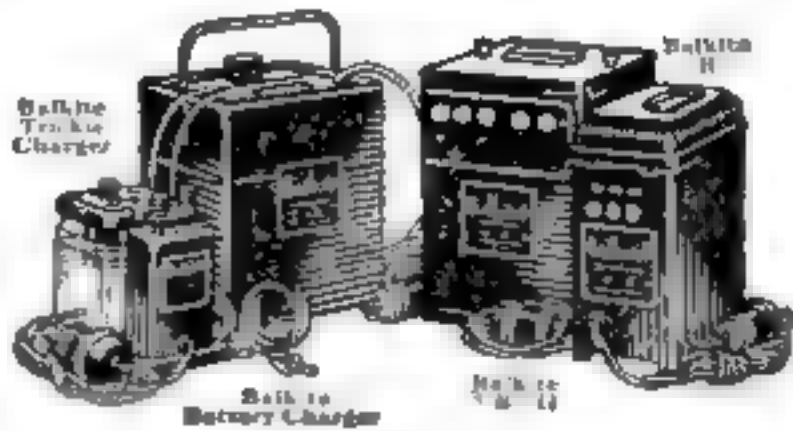
A centered casting for a small bushing

Short bushings with small holes can be held in a lathe chuck bolted to the table of a drill press and drilled and reamed more rapidly than in a lathe.

(Continued on page 136)



Old Bill, shop foreman



## Balkite Radio Power Units

the ideal radio power supply

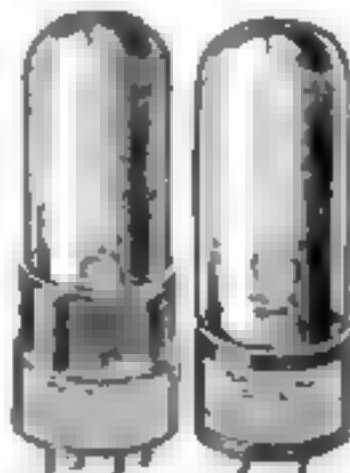
The Balkite Battery Charger and Balkite Trickle Charger for charging "A" batteries—entirely noiseless. Balkite "B" replaces "B" batteries—for sets of 5 tubes or less. Balkite "B" II—for sets of 6 tubes or more.

FANSTEEL PRODUCTS CO., Inc., North Chicago, Ill.

## FANSTEEL Balkite Radio Power Units

BALKITE BATTERY CHARGER BALKITE TRICKLE CHARGER BALKITE "B" BALKITE "B" II

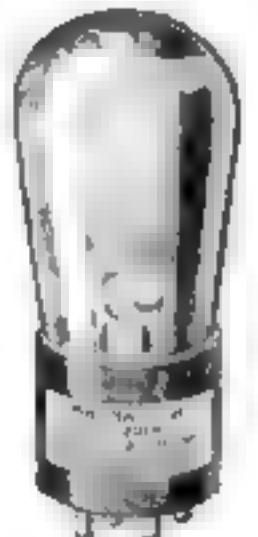
## Supremacy



**M**AGNATRONS have achieved leadership in the vacuum tube field, but the constant vigilance which has brought these tubes to the fore has not for one moment been lessened. Every part, from contacts to filaments, is tested, constantly tested.

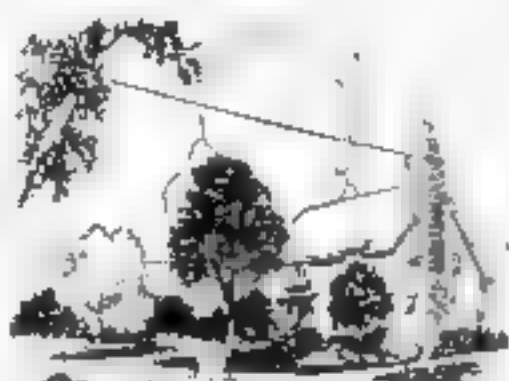
The Magnatron DC 251A, DC 199, and DC-199 (large base) now list for only

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## MAGNATRONS





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LEADING radio engineers agree that an enameled aerial is superior to a bare copper aerial, because the rapid corrosion of the bare copper wire, exposed to atmospheric fumes and smoke, quickly reduces the aerial efficiency.

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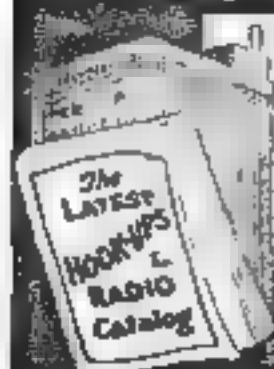
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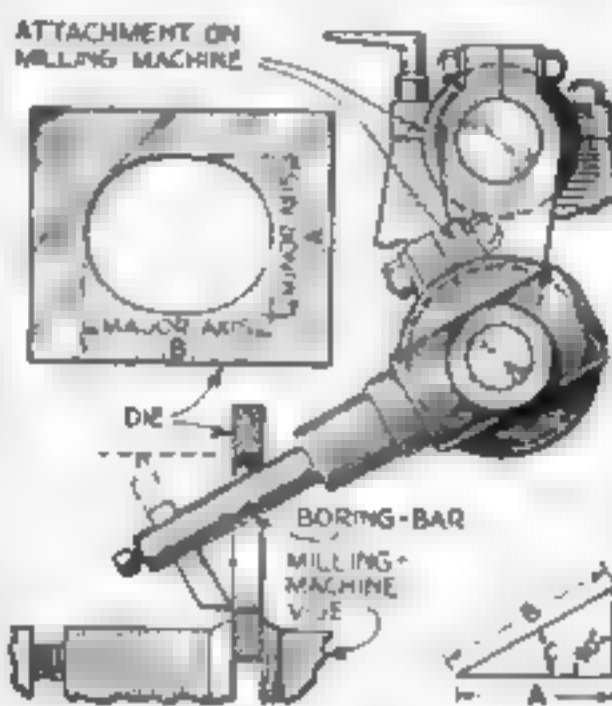
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## Milling Machine Used for Cutting an Ellipse

DIE-MAKERS having to machine elliptical holes may avoid the tedious and difficult task of filing to a line after drilling out the core if they have access to a vertical milling-machine attachment. By using the method illustrated a perfect ellipse may be generated. The die blank is held in a vise or on an angle plate, as convenient. A boring-tool is held in the attachment in the usual way.

For ordinary work the angular setting of the attachment may be found by laying out the work on paper and measuring the angle with a draftsman's protractor. If  $A$  is the minor axis of the ellipse and  $B$  the major axis, lay off a right triangle with  $A$  as the base and  $B$  the hypotenuse.



Milling machine set to cut an ellipse, and how to find the correct angle by means of a diagram.

The angle  $C$  between these sides is the angle to which to set the attachment.

The angle may be computed for more accurate work. The cosine of an angle is equal to the side adjacent to the angle divided by the hypotenuse. In the illustration,  $A$  is the side adjacent, and  $B$  the hypotenuse. Assuming that these are 4 and 6 in. respectively, then the cosine of the angle  $C$  is four divided by six, or .666. Referring to a table of natural sines and cosines to be found in any machinist's handbook, the cosine .666 is found to belong to the angle 48 deg. 46 min. This represents very accurately what the angular setting of the attachment must be.

## How to Drill Small Bushings

(Continued from page 125)

Then they are finish-turned on an arbor between centers in the usual way.

When it is desired to machine bushings in this way, a center can be cast in one end for starting the drill, as illustrated. This saves laying out the center. All that is necessary is to chuck the work as previously suggested and bring the drill to bear in the center of the casting.

A COMPOUND of ten parts tallow to one part mercury is a dependable help in keeping tools from rusting.



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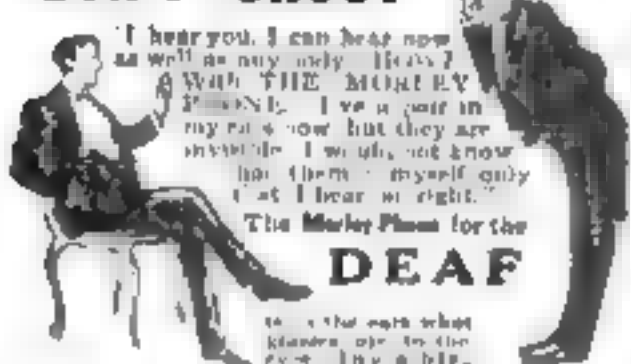
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## "DON'T SHOUT"



The Morley Phone for the DEAF

Long and heretofore, August 1st, 1925, 11, 12 and 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

Long and heretofore, August 1st, 1925, 11, 12 and 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

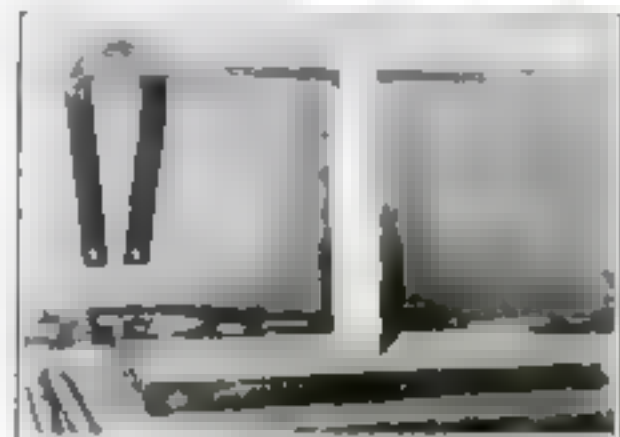
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## Ways to Gage Furnace Heat

(Continued from page 138)

of carbon, certain restrictions should be applied, for below .9 per cent there is a temperature range when steel loses its magnetic properties before attaining the correct quenching heat. This restriction is practically of small importance, however, and can be corrected by heating for a little longer time.

To determine the moment steel loses its magnetic properties, a magnet in the form of a balance must be constructed. If pieces are brought to it during the heating process, the moment of cessation of its being set oscillating by this action will fix the proper quenching heat. It generally is better not to bring the piece to the balance, but to put it the other way



Another magnet balance for determining the correct temperature for hardening steel in the way described by Mr. Israelovich. This device was made by William J. Edmonds, Jr. of Whitehall N. Y. for emergency use when a regular pyrometer was not available.

around, because in the first case the piece has a chance to get considerably cooler before it is plunged into the quenching bath. Of course, this may be offset by heating the piece to a little higher temperature, which is quite safe.

The magnet may be made of an old file. Care must be taken to saw the ends off squarely and not in an arc, as in the latter case the lines of force disperse and the magnet becomes somewhat weaker. A convenient way of mounting it is shown in the accompanying drawing (on the preceding page). The attraction between the magnet and its iron mounting will cause it to retain the position shown.

Sometimes, when the magnet cannot be employed directly, as when a portion of the piece is heated, a trick may be resorted to. It consists of heating along with the main piece another smaller piece of steel of the same composition and determining by it the temperature of the main piece.

## Remedying Loose Pipe Joints with Brass Wire Cloth

WHEN threads are cut in a lathe on pipes that are  $2\frac{1}{4}$  in. or more in diameter, it sometimes happens that the correct diameter is not obtained and the fitting will screw on loosely, right up to the shoulder. The joint can be made tight by wrapping around the threads a length of brass wire cloth of from 60 to 80 mesh. This should be daubed freely with litharge or red lead.—F. N. C.

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throughout Saint Peters, Rome



His Holiness the Pope seated on his throne upon the occasion of the recent consecration of Saint Peter's. The microphone is on the right side of the throne.

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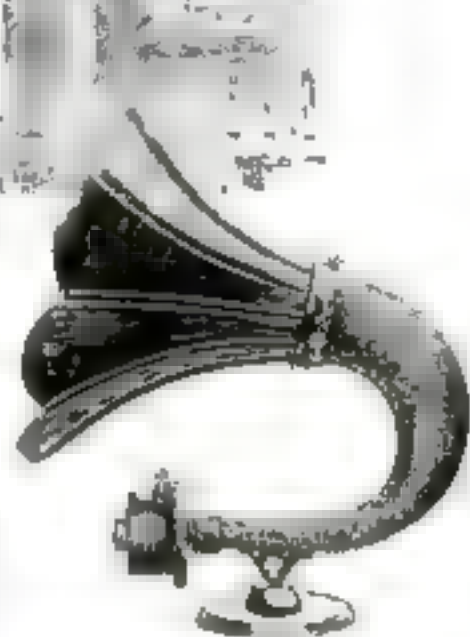
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The World's Standard Loud Speaker



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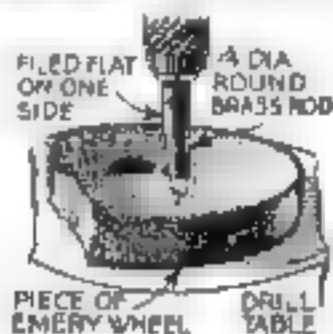
**AGENTS**





## Drilling an Emery Wheel with a Brass Rod

"COULD you drill a hole in an emery wheel with a brass rod?" a tool-maker asked me the other day. I told him that I did not believe it possible. He took a short length of  $\frac{1}{4}$ -in. rod, filed it as shown, put it in a drill press



Piercing a hard grinding wheel

at high speed, and drilled a hole through an old emery wheel about  $\frac{1}{2}$  in. thick in almost no time. He did the same stunt with cold-rolled steel, and even a wire nail may be used.—S. L. ROBERTS.

## Punch and Die Making

(Continued from page 140)

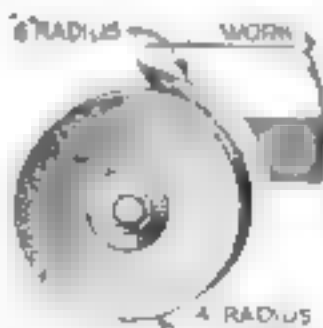
drilled, remove the core by cutting away the bridge with the broach shown in Fig. 10. Then scribe the outline of the templet on the punch pad, stripper, and shoe. These now are ready to be filed. The lines should be split as nearly as possible on the die and punch pad, but the stripper and shoe should be a trifle larger for clearance.

The filing can be done with assurance by a mechanic who has had little experience in this class of work by the method illustrated in Fig. 11. A hardened and ground parallel strip and a piece of hardened drill rod, both of which have the  $\frac{1}{4}$ -deg. taper, as shown in Fig. 11, are required. These file guards are placed so that they split the scribed outline on the die. They are made fast with a few drops of solder. An old saw blade is used as a safety guard, as indicated, to prevent the file edge from touching a part already finished.

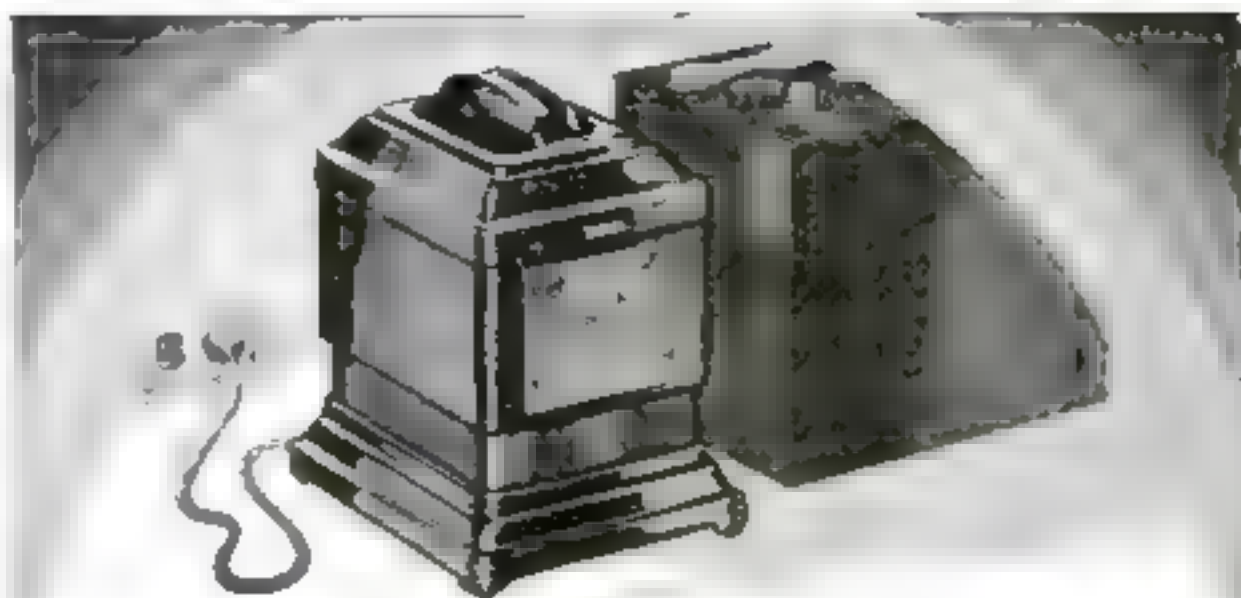
The four parts are finished in this manner and the punch is made as previously described.

## Grinding a Radius Larger than the Wheel Available

ANY one who has tried to grind an accurate radius forming tool when the wheel available was smaller than the required radius, will appreciate the method suggested in the accompanying illustration. By tilting the grinder table to an angle that is found by the cut-and-try method and grinding on the edge of the wheel as shown, I have ground tools to a templet with sufficient accuracy to pass an inspector.—K.C.



Among the articles scheduled for forthcoming issues are "The Shipshape Toolroom," "Methods of Repairing Gears," and "An Improved Combination Boring-Tool."



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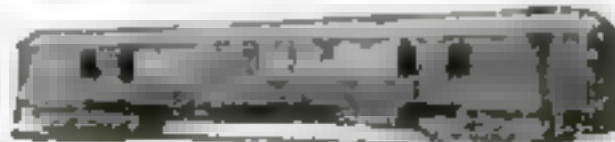
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## How to Fit Up a Lathe to Cut Small Cams

**I**N MANY small shops where there is not sufficient work to warrant the expense of a special cam-cutting machine, it sometimes is necessary to produce a cam by some makeshift method. The lathe is well adapted for cutting a variety of cams and can be fitted up for that purpose with little expense.

As an illustration of how this class of work may be done on the lathe, the cylinder cam illustrated is a good example. In this case a flanged plate is made, with the outer face conforming to the cam itself. It is a master cam and produces the same motion. This plate or master

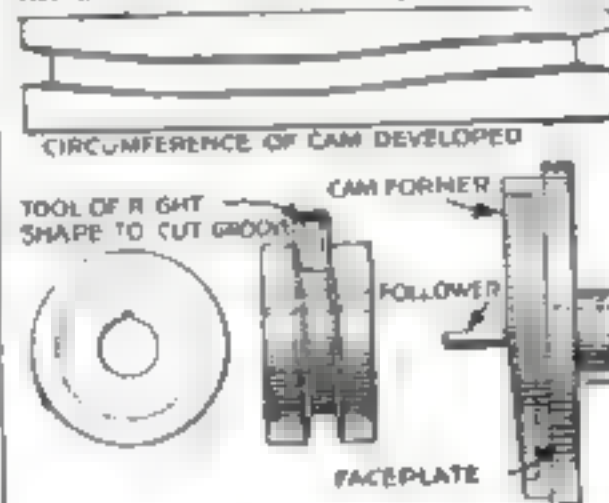


Diagram showing typical cam and method of using a forming plate or master cam.

cam is bolted to the faceplate of the lathe and a follower, attached to the lathe carriage, bears against it. A spring or weight also is attached to the carriage by any convenient method to insure a uniform contact and exert sufficient pressure against the plate to overbalance the pressure of the cut.

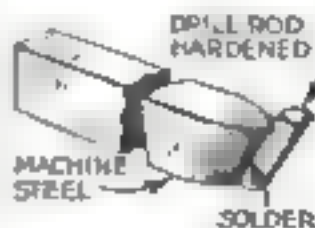
The cam blank is mounted on an arbor that is driven with a dog. A tool of the right shape is made for the groove. This is fed in slowly by hand to the proper depth. The tool should have sufficient side clearance so that it will not drag or tear the metal.

A great variety of cams can be produced by this method and in many cases the time required for making them will compare favorably with special cam-cutting machines.—J. A. HORTON, Sebring, Fla.

## Small Fillet Tool for Lathe

**S**ERVICEABLE fillet tools can be made quickly and cheaply as illustrated. A piece of machine steel  $\frac{3}{4}$  by 1 in. is used for the shank; the cutting point is made of drill rod. The end of the shank is grooved to receive the drill rod.

Cut a short piece of the rod and bevel one end to give it the proper rake and clearance angle. After hardening and tempering it, fasten it to the shank with solder. Build a bank of solder well up in back of the point and along the edge on each side.—H. L. W.



How the tool is made

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Earn While You Learn  
21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100-101-102-103-104-105-106-107-108-109-110-111-112-113-114-115-116-117-118-119-120-121-122-123-124-125-126-127-128-129-130-131-132-133-134-135-136-137-138-139-140-141-142-143-144-145-146-147-148-149-150-151-152-153-154-155-156-157-158-159-160-161-162-163-164-165-166-167-168-169-170-171-172-173-174-175-176-177-178-179-180-181-182-183-184-185-186-187-188-189-190-191-192-193-194-195-196-197-198-199-200-201-202-203-204-205-206-207-208-209-210-211-212-213-214-215-216-217-218-219-220-221-222-223-224-225-226-227-228-229-230-231-232-233-234-235-236-237-238-239-240-241-242-243-244-245-246-247-248-249-250-251-252-253-254-255-256-257-258-259-260-261-262-263-264-265-266-267-268-269-270-271-272-273-274-275-276-277-278-279-280-281-282-283-284-285-286-287-288-289-290-291-292-293-294-295-296-297-298-299-300-301-302-303-304-305-306-307-308-309-310-311-312-313-314-315-316-317-318-319-320-321-322-323-324-325-326-327-328-329-330-331-332-333-334-335-336-337-338-339-340-341-342-343-344-345-346-347-348-349-350-351-352-353-354-355-356-357-358-359-360-361-362-363-364-365-366-367-368-369-370-371-372-373-374-375-376-377-378-379-380-381-382-383-384-385-386-387-388-389-390-391-392-393-394-395-396-397-398-399-400-401-402-403-404-405-406-407-408-409-410-411-412-413-414-415-416-417-418-419-420-421-422-423-424-425-426-427-428-429-430-431-432-433-434-435-436-437-438-439-440-441-442-443-444-445-446-447-448-449-450-451-452-453-454-455-456-457-458-459-460-461-462-463-464-465-466-467-468-469-470-471-472-473-474-475-476-477-478-479-480-481-482-483-484-485-486-487-488-489-490-491-492-493-494-495-496-497-498-499-500-501-502-503-504-505-506-507-508-509-510-511-512-513-514-515-516-517-518-519-520-521-522-523-524-525-526-527-528-529-530-531-532-533-534-535-536-537-538-539-540-541-542-543-544-545-546-547-548-549-550-551-552-553-554-555-556-557-558-559-560-561-562-563-564-565-566-567-568-569-570-571-572-573-574-575-576-577-578-579-580-581-582-583-584-585-586-587-588-589-590-591-592-593-594-595-596-597-598-599-600-601-602-603-604-605-606-607-608-609-610-611-612-613-614-615-616-617-618-619-620-621-622-623-624-625-626-627-628-629-630-631-632-633-634-635-636-637-638-639-640-641-642-643-644-645-646-647-648-649-650-651-652-653-654-655-656-657-658-659-660-661-662-663-664-665-666-667-668-669-670-671-672-673-674-675-676-677-678-679-680-681-682-683-684-685-686-687-688-689-690-691-692-693-694-695-696-697-698-699-700-701-702-703-704-705-706-707-708-709-710-711-712-713-714-715-716-717-718-719-720-721-722-723-724-725-726-727-728-729-730-731-732-733-734-735-736-737-738-739-740-741-742-743-744-745-746-747-748-749-750-751-752-753-754-755-756-757-758-759-760-761-762-763-764-765-766-767-768-769-770-771-772-773-774-775-776-777-778-779-780-781-782-783-784-785-786-787-788-789-790-791-792-793-794-795-796-797-798-799-800-801-802-803-804-805-806-807-808-809-810-811-812-813-814-815-816-817-818-819-820-821-822-823-824-825-826-827-828-829-830-831-832-833-834-835-836-837-838-839-840-841-842-843-844-845-846-847-848-849-850-851-852-853-854-855-856-857-858-859-860-861-862-863-864-865-866-867-868-869-870-871-872-873-874-875-876-877-878-879-880-881-882-883-884-885-886-887-888-889-890-891-892-893-894-895-896-897-898-899-900-901-902-903-904-905-906-907-908-909-910-911-912-913-914-915-916-917-918-919-920-921-922-923-924-925-926-927-928-929-930-931-932-933-934-935-936-937-938-939-940-941-942-943-944-945-946-947-948-949-950-951-952-953-954-955-956-957-958-959-960-961-962-963-964-965-966-967-968-969-970-971-972-973-974-975-976-977-978-979-980-981-982-983-984-985-986-987-988-989-990-991-992-993-994-995-996-997-998-999-1000-1001-1002-1003-1004-1005-1006-1007-1008-1009-1010-1011-1012-1013-1014-1015-1016-1017-1018-1019-1020-1021-1022-1023-1024-1025-1026-1027-1028-1029-1030-1031-1032-1033-1034-1035-1036-1037-1038-1039-1040-1041-1042-1043-1044-1045-1046-1047-1048-1049-1050-1051-1052-1053-1054-1055-1056-1057-1058-1059-1060-1061-1062-1063-1064-1065-1066-1067-1068-1069-1070-1071-1072-1073-1074-1075-1076-1077-1078-1079-1080-1081-1082-1083-1084-1085-1086-1087-1088-1089-1090-1091-1092-1093-1094-1095-1096-1097-1098-1099-1100-1101-1102-1103-1104-1105-1106-1107-1108-1109-1110-1111-1112-1113-1114-1115-1116-1117-1118-1119-1120-1121-1122-1123-1124-1125-1126-1127-1128-1129-1130-1131-1132-1133-1134-1135-1136-1137-1138-1139-1140-1141-1142-1143-1144-1145-1146-1147-1148-1149-1150-1151-1152-1153-1154-1155-1156-1157-1158-1159-1160-1161-1162-1163-1164-1165-1166-1167-1168-1169-1170-1171-1172-1173-1174-1175-1176-1177-1178-1179-1180-1181-1182-1183-1184-1185-1186-1187-1188-1189-1190-1191-1192-1193-1194-1195-1196-1197-1198-1199-1200-1201-1202-1203-1204-1205-1206-1207-1208-1209-1210-1211-1212-1213-1214-1215-1216-1217-1218-1219-1220-1221-1222-1223-1224-1225-1226-1227-1228-1229-1230-1231-123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# A Simple Lesson in Arithmetic For Men Who Want More Money

By A. H. WARD

You may think that my arithmetic is funny, but it certainly worked for me. You can add ten and ten in the ordinary way and you'll never get more than \$20—and that's just about what I was earning a week before I left the States for twenty months' active service in France. When I came back I determined that I would not go back to the old grind! I found a way to put one ten alongside of the other so that the total made over a thousand dollars—and that's what I averaged every 30 days for the last twelve months. Through the simple method I'll tell you about I made \$12,500 last year.

THERE'S no reason why any ambitious man should not grow in my footsteps. I read an advertisement, just as you are now reading my story—it told about W. Hurtle of Chicago who had been in the R. R. Mail service for ten years. Hurtle made a sudden change—against the advice of his friends—and made over \$1000 the first two weeks. Barry of Winterset, Iowa—a farm-hand—made \$1000 the first month. George Kearns made \$523.00 the first two weeks. F. Wynn made \$554.37 the first seven days and Miller, a former stenographer, made \$100 a week after making this change.

Well, man, I sat up and took notice. If they could do these things—ordinary men like myself—I knew that I had a chance. I investigated and found that what the advertisement said was true. Fact is, you can figure it out for yourself in simple logic. Consider these two points:

## Easy for Two Reasons

First. There is no money and no future in the routine job. Everyone knows that. If you want to make the real money, you must get into the producing end of the business—be a salesman. Wait, now, don't let the word SALESMAN scare you. For the second thing is this: Salesmanship is governed by rules and laws. It is just like learning the alphabet. And men who always have thought that salesmen are "born" and not made, very quickly learn that there are certain definite ways to approach different types of prospects to get their undivided attention—certain ways to stimulate keen interest—certain ways to overcome objections—batter down competition and make the

product net. And any man can learn these simple principles. I know that because I've proved it to myself.

Of course I didn't know it then. The idea just appealed to my common sense, or reason, or whatever you call it. I sent for the book that Mr. Greenslade, the president of The National Salesmen's Association, will send you absolutely free to any man who writes.

## This Free Book Started Me

After reading this remarkable book I understood. Don't think in boasting. I'm just stating facts. Within one year I had averaged over \$1000 a month in either \$3 or \$5 of the first year—and a position was elected as an officer of the National Salesmen's Association.

Now don't measure or stand me. I can't say that you can do as well. You may not make a thousand dollars the first month. You may not have as much determination to succeed as I had, you may not have the driving force behind your efforts to overcome me. But I do say that some things go. It's a matter of fact that you can do it. You should at least investigate. You can't help but benefit and if you're any man at all you should go in for triple your income without having to.

I'm not particularly keen for the publicity this story is giving me. My friends may laugh at me for allowing this story to be printed here with my name but I do so anyway because I realize that my story may be instrumental in showing other men a quick, easy way to realize their ambitions and make the dreams of their hearts come true.

## Send Today for Free Book

If you really want the good things of life, be certain that this month you buy. I urge you to send for this book at once. Mr. Greenslade, I will send you one and it will cost you nothing. Mr. Greenslade, the book that started me up the road, is now in your hands. It is a book that will go ahead you and be with you every day. And on the other hand you may find a way to double it and you may find a way to triple it. It will be a great help to you and will be a great help to you every day with your name and address.

Yours for success,  
A. H. Ward.

Write for Mr. J. E. Greenslade, President,  
National Salesmen's Training Association,  
Dept. R-15, N. S. T. A. Bldg., Chicago, Illinois.



## National Salesmen's Training Association

Dept. R-15, N. S. T. A. Bldg., Chicago, Ill.

MR. J. E. GREENSLADE, PRESIDENT,  
National Salesmen's Training Association,  
Dept. R-15, N. S. T. A. Building, Chicago, Illinois

Send me free the book that gave Mr. Ward his start. This does not obligate me.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_





## Daring Young Men Needed in Aviation

**T**HERE is no field of work in the world today which offers such amazing opportunities to young men of daring and who love adventure, as does Aviation. Although still in its infancy, there is a crying demand in Aviation for young men with courage, nerve and self-reliance. For those who can qualify there will be thousands of highly paid jobs which will lead quickly and surely to advancement and success.

### Big Opportunities Await the Trained Man

Look over the fields of work which are open to the young man today. You will find that Aviation is the ONE FIELD that is not overcrowded—the ONE FIELD in which there is plenty of room at the top. Think of it! Only 21 years ago Orville and Wilbur Wright made the world's first airplane flight. Now airplanes fly around the world. Yes, Aviation offers the same wonderful opportunities today that the automobile and motion picture industries did 15 and 20 years ago. Men who got in on the ground floor of those industries made fortunes before others woke up. AVIATION IS NEW! It clamors for nifty young men—and the trained man has the world before him in Aviation.

### Easy to Become an Aviation Expert—\$50 to \$100 a Week

You can qualify now quickly for one of these exciting, highly paid jobs through a new, sure, easy method of training. The study of Aviation is almost as interesting as the work itself. Every lesson is fascinating and packed full of interest. That's why Aviation is so easy to learn—you don't have to force yourself to study—once you start, you can't get enough of it. Only one hour of spare time a day will give you the basic training in an amazingly short time.

One student, S. F. McNaughton, Chicago, says:

"Your lessons are like a romance and what is more after one reading the student gets a thorough understanding. One never tires of reading them." James Powers, Pa., another student, says: "I am indeed surprised that such a valuable course can be had from such practical men for so little cost."

### Personal Instruction by Experienced Men

#### PREPARE For One of These POSITIONS

Aeronautical Instructor  
\$40 to \$150 per week  
Aeronautical Engineer  
\$100 to \$300 per week  
Aeronautical Contractor  
Enormous profits  
Aeroplane Repairman  
\$40 to \$75 per week  
Aeroplane Mechanician  
\$40 to \$65 per week  
Aeroplane Inspector  
\$50 to \$70 per week  
Aeroplane Salesman  
\$5000 per year and up  
Aeroplane Assembler  
\$45 to \$45 per week  
Aeroplane Builder  
\$75 to \$200 per week

Men who have had actual experience in Aviation give you personal attention and guide you carefully through your training. They select the lessons, lectures, blueprints and bulletins. They tell you the things that are essential to your success. Every lesson is easy to read and quickly understood.

## Big Book on Aviation FREE



Send coupon below for New Free Book, just out, "Opportunities in the Airplane Industry." It is interesting and instructive and will show you many things about Aviation which you never knew before.

Only a limited number offered—get yours before the edition is exhausted.

**AMERICAN SCHOOL OF AVIATION**  
Dept. 1367, 3601 Michigan Ave., Chicago, Ill.

**AMERICAN SCHOOL OF AVIATION,**  
3601 Michigan Ave., Dept. 1367,  
Chicago, Ill.  
Without any obligation, send me your Free Book, "Opportunities in the Airplane Industry" also information about your Course in Practical Aeronautics.

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## It Is Easy to Succeed

(Continued from page 9)

write to the advertisers who are ready to help you reach the top of the profession or trade you have chosen.

The man who has a driving ambition to get ahead can secure a specialized training without its interfering with his present employment and at a cost he can afford.

Correspondence schools, extension courses, and educational books show the way to the man handicapped by a lack of education.

POPULAR SCIENCE MONTHLY is the great meeting-place for men-who-want-to-succeed and the schools and publishers who can help these men achieve their ambitions.

Every month you will find in POPULAR SCIENCE MONTHLY hundreds of advertisers holding open to you the door to success. Starting with this issue these money-making opportunities will be grouped together for your convenience in finding the path you want to follow. Read every advertiser's offering, see what the opportunity is in each field, decide which calling you have the greatest natural interest in, and then go to it with all the determination you possess.

Only education, plus determination to succeed, can make you a success in life.

As a further incentive to succeed we are offering \$100 in Cash Prizes for the best letters telling us the advertisements our readers like best—and why. See the details of this offer on page 142.

### New Process of Welding

**C**HRONIUM and other metals that cannot be welded by ordinary methods are conquered by a new discovery made by Dr. Robert W. Wood, of the Johns Hopkins University, working for the General Electric Company. The stubborn metals are welded by breaking up hydrogen into dissociated atoms, which is done with electricity.

### Special Rooms for Tall Men

**W**HEN tall men stop at hotels they often find accommodations cramping. Ever obliging, one big New York City hotel is altering rooms on its top floor, especially to suit six- and seven-footers.

Door frames will be built so that the lengthy guest need not bump his head. Extra long bathtubs and beds and other furniture built to special measurements, will add to the visitors' comfort.

### Chew Well to See Well

**C**HEW well if you would see well, urges Sir Arthur Keith, a great British anatomist. Decreased exercise of the jaws, and not eye strain, is causing short sight, he claims. Diminished use of the jaws in masticating the soft foods of modern diet, he asserts, is changing the shape of the face, lengthening the eye sockets, thus elongating the eyeballs and weakening vision.

### "Up to the Minute"

I find POPULAR SCIENCE MONTHLY as interesting as my radio set, and they both keep me informed right up to the minute.—E. H., Bogota, N. J.







● This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.



# Give Me 5 Days and I'll Give You a Magnetic Personality Let Me Prove It — FREE!

**I CAN** so magnetize your personality that people will be drawn to you at once, irresistibly.

I can make you a magnet of human attraction so that you are popular everywhere, in any society.

I can show you how to use the amazing principle of magnetic control to win quick and conspicuous success in your business or profession.

I can place in your hands the key to supreme power and happiness—give you a great new confidence in yourself—overcome almost at once any timidity or self-consciousness you may have.

I can give you a glorious new magnetic personality so that you can influence the minds of others, attract people to you instantly, be popular and well-liked wherever you go!

Let me prove it. Give me 5 days, and if in that time you do not experience a new surge of personal power, if you do not find yourself making friends wherever you may be, if you do not discover yourself on the road to happiness, wealth, success—guided by my principles of personal magnetism—the test will cost you nothing whatever. You are the judge.

## What is Personal Magnetism?

You have it—everyone has it—but *only the exceptional man or woman knows how to use it.*

Personal magnetism is not a fad or fancy, not some sudden discovery or some new psychological theory. It is you, your manner, your self-made magnetic. It is a force as irresistible as the force of the actual magnet, drawing a bit of steel to itself. No leader of men has long survived without it. No great orator

or musician or actor could hold audience attention without it. No salesman, no business man, can win an outstanding success without it. Personal magnetism! It is your greatest capital—greater by far than wealth, than good looks. It is you, made magnetic! It is you, with a personality so fascinating and irresistible that people are drawn to you as steel is drawn to a magnet!



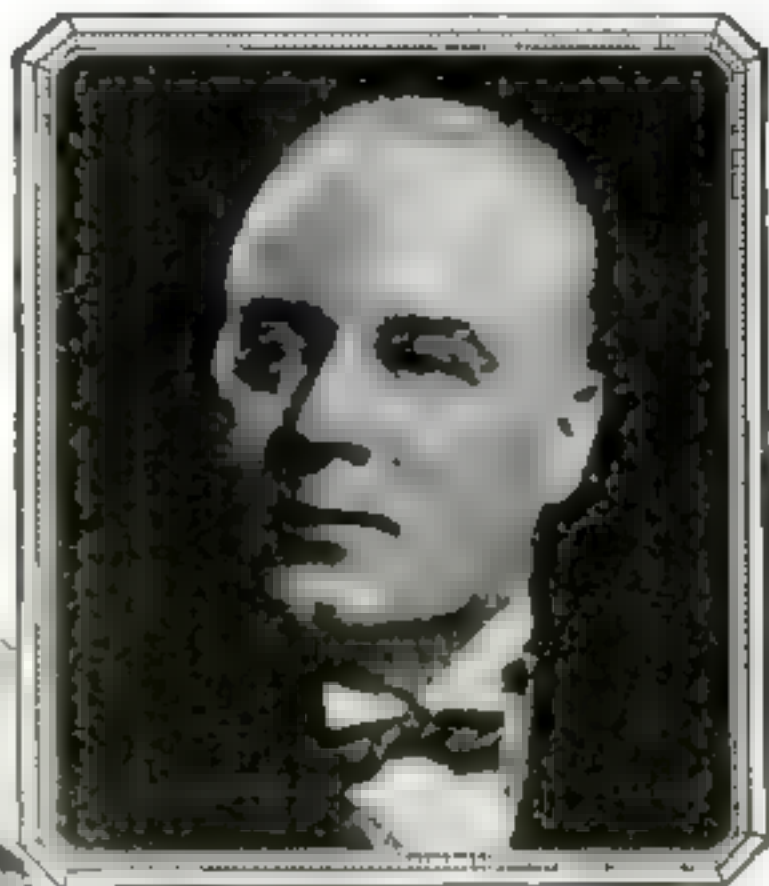
Think what personal magnetism will mean to you in business—in your contact with men and women. You will win! You will get what you want!

## My Method Releases Your Personal Magnetism

No long course of study. No tedious mental exercises. Not the slightest inconvenience or self-denial. Just a simple, clear, age-old principle that taps the vast thought and power resources within you, releases the full sweep of your magnetic potentialities—and makes you almost a new person from what you were before. A principle that never fails to work, because it conspires with Nature to make you the dynamic, forceful, fascinating person you were intended to be.

## Not Hypnotism—But Magnetism!

Please do not mistake my method for hypnotism. Its laws and its results are exactly opposite. Hypnotism deadens—magnetism imparts a joyous exhilaration to body and mind. Hypnotism paralyzes the will—magnetism animates, inspires, sharpens and strengthens the mental faculties.



...the study and scope of Personal Magnetism is as broad as life itself. "Fires of Magnetism," "Sex Influences," "The Magnetic Voice," "Physical Magnetism," "The Magnetic Eye," "The Road to Power" and "The Winning Personality" are only a few of the subjects covered in this amazing series of books.

The study and scope of Personal Magnetism is as broad as life itself. "Fires of Magnetism," "Sex Influences," "The Magnetic Voice," "Physical Magnetism," "The Magnetic Eye," "The Road to Power" and "The Winning Personality" are only a few of the subjects covered in this amazing series of books.

## Remember My 5-Day Free Proof Offer! Send Off the Coupon TODAY

You must see them for yourself—examine them—let them influence indelibly your own personality. If you aren't stirred and inspired in the 5-day free period, return them and they cost you nothing. Otherwise keep them as your own and remit only \$4 in full payment for the four books. You are the sole judge. You do not pay unless you are delighted. And then you pay only \$3 for the four remarkable books!

You simply can't delay! Clip and mail this coupon NOW. Ralston University Press, Dept. 14-S, Meriden, Conn.

**RALSTON UNIVERSITY PRESS,**  
Dept. 14-S, Meriden, Conn.

All right—I'll be the judge. You may send me the four volumes "Cultivation of Personal Magnetism" for 5 days FREE EXAMINATION in my home. Within the 5 days will either remit the special low price of only \$3.00 for the four books complete, or return them without cost or obligation.

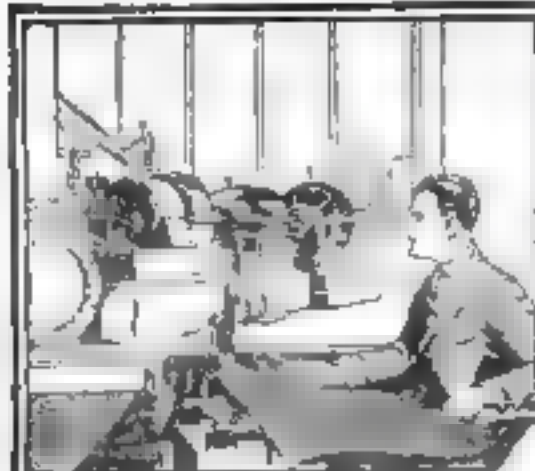
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Address .....  
City ..... State .....



You will be astounded to see how popular you quickly become—how people are drawn to you. Never again will you feel lonesome at a party—forgotten in a crowd! You will be—MAGNETIC!







Be Superintendent of an Electrical POWER PLANT



Own Your Own Electrical REPAIR SHOP



Have Electrical Construction Jobs



Be an Electrical CONTRACTOR

Train At Home  
for a fine  
**ELECTRICAL  
JOB** and  
a big **RAISE  
IN  
PAY!**

## Go into ELECTRICITY!

--the Business of a Million Opportunities

Be an Electrical Expert. Go into the one great industry where it's easy to get rich or to make money & make a real success. You don't need money in the bank or need to get ahead in electricity and you need no training, honest, complete training, such as I guarantee.

### BIG JOBS OPEN Everywhere!

Look at the building business. Thousands of Electrical Contractors are getting rich. Their men are making \$10 to \$20 a day. Look at the big cities where big money is made. Look at the great business of every kind of electrical machinery. What the work of the world is being done by electricity and the men who trained men exceed the amount

## If you're now earning less than \$40 a week

--If you want to be an ELECTRICAL EXPERT--If you want to step quickly into the class of men earning from \$40 to \$250 a week--write me at once! This million dollar school offers ambitious fellows their big opportunity to learn every branch of Electricity at home in spare time by a new, practical JOB-METHOD.

### Learn Electricity Quick by Dunlap "Job-Method"

My training is simple a school-boy can grasp it instantly. Common schooling is all you need. No previous experience required. But my students make rapid progress because I teach them in actual functioning jobs with step-by-step lessons and make a success of them without extra cost. The first part of my training is APPLIED ELECTRICITY--a simple course in which I give you the second half I give you Electrical Engineering subjects. I give you Electrical Drafting, Radio, Vacuum tube Electricity, and many other valuable subjects, all for one main price, and on easy terms.

### Train for These Jobs

Power Plant Superintendent, \$5,000 to \$15,000 a year. Construction Foreman, \$3,500 to \$10,000 a year. Chief Electrician, \$4,000 to \$12,000 a year. Electrical Draftsman, \$3,000 to \$10,000 a year. Automotive Electrical Expert, \$3,500 to \$12,000 a year.

### EARN MONEY While Learning

Design-training combines money making with learning. I give you a new way of learning. I call it the "JOB-METHOD" and it gives you a more quick and easily than old-fashioned ways of learning. Early in your training I give you money to live on. Then, as you progress, I give you more money. Radio-Engineering. Five times the money. Work on the radio. I show you how to get square with the world. I will pay for

### THESE 4 BIG ELECTRICAL OUTFITS GIVEN

to you without the heavy outlay of extra charge. Not a penny more--just simple thing FREE to include you in control. But only study and practice. I will make a new equipment. The main size and of the same type as the big fellows in a power plant. Not a penny more a regular power plant. Keys in Alternating or Direct Current, or 12-volt arm electric system. Comes to you knock-down. It's part of your job to wind the armature and assemble it. That's the way you learn every branch of Electricity by the Dunlap Job-Method.

### Get My PAY-DOUBLING OFFER!

Before you put time and money into training, you want to know if it will lead to a better job and higher pay. I will answer that in plain English. Get my training my wonderful new guaranteed job opportunity. I will give you the facts about your opportunities in Electricity when you are Dunlap trained and when you have the backing of the American School. Before you enroll for an evening training get the facts about my training. Write me today.

**THE AMERICAN SCHOOL** is chartered under the laws of Massachusetts, as an educational institution. Not just a school. Established 70 years. Over 200 Engineers, Electricians, and Educators have prepared the courses used in these vocational home study courses. The courses of our training are based on one of the largest VOCATIONAL TRAINING institutions in the world. You can be successful at the many ways we help our students and graduates progress to success.

### I WANT TO BE AN ELECTRICAL EXPERT!

Chief Engineer Dunlap  
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☐ I want to be an Electrical Expert. Please rush literature, no money back, complete information, money saving offers.

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State \_\_\_\_\_

Chief Engineer Dunlap, Electrical Division  
**AMERICAN SCHOOL**  
Dept. E-775  
Drexel Ave. & 58th St. CHICAGO





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 This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 9.

## Houdini—The Man

(Continued from page 156)

"My only hope of saving myself lay in finding the hole through which I had been dropped. I don't believe I ever did so much fast and serious thinking before or since. As swiftly as I could, I released one of my hands. Then I began moving around in circles, dragging my body along by digging the handcuff on the other wrist into the ice above my head. Gradually I made my circles larger, and at last reaching upward, my hand touched the edge of the hole. Seizing this with the other hand, I anchored myself, then went about my work of releasing myself from the remaining bonds.

"A few seconds later I climbed out of the water to face a white-faced, frightened group of persons who, because of the length of time I had spent in the river, were ready to give me up for lost. And to this day they have never known how nearly right they were!

"I HAVE had many other similar experiences, but those I have described probably will suffice to show that a man who does my kind of work does not always tread a path of roses.

"However," added Houdini, with a meaning glance around his library, "there are compensations."

And as I followed his glance I was convinced that there were. Houdini's handsome home, his marvelously stocked bookshelves, his art treasures, are unmistakable tokens of material success. The autographed photographs of celebrities that line his walls are indicative surely of the esteem in which he is held by the leading men of his generation.

The fact that the Society of American Magicians nine times has elected him its president is proof conclusive that present-day magicians acclaim him "master." He has the love of a devoted wife. He has earned the leisure to indulge himself in the research and study that are his passion. Every man, woman, and child in the civilized world undoubtedly knows his name. With what other gifts could Fortune shower a man?

IN THE first of his extraordinary series of stories for POPULAR SCIENCE MONTHLY, Houdini will relate in next month's issue some of his dramatic experiences in exposing fraudulent mediums. He will tell how, by employing ingenious tricks of the magician, he has laid bare the trickery of unscrupulous persons who prey on deluded thousands.

Houdini's own story is full of exciting action and romance. You will not want to miss a single installment of this amazing series. To avoid disappointment, order your copies of the magazine from your newsdealer in advance.

To DRINK, or not to drink—with meals—has long been an open question. Dr. A. C. Ivy, a University of Chicago physiologist, says "go ahead." Drinking water produces more complete digestion stimulation for the gastric glands, he maintains, and permits more complete absorption of food into the blood stream.

# Fast Life Wrecks the Nerves

by PAUL von BOECKMANN

Lecturer and Author of numerous books and treatises on Mental and Physical Energy, Respiration, Psychology and Nerve Culture

WE are living in the age of SPEED the mile-a-minute life. We crowd two or five years of life into one. We hurry; we worry; and we dissipate, little realizing that there must come an end to our supply of Nerve Force—that we will become nervous wrecks.

Long before a person reaches the final stages of nervous collapse, he passes through months and even years of sub-normal nerve power, which seriously handicaps him in life, undermines his constitutional powers and causes all kinds of organic and mental disorders. It would be proper to call these people "near-neurasthenics."

There are countless "near-neurasthenics" about us everywhere—in the streets in the cars, in the theatres, in your business, and especially in your own home—right in your own family.

They are said to be troubled with "nerves," a condition which is not considered serious, but admitted to be most annoying, especially to those who must associate with people who have "nerves."

"Nerves" is not a malady which manifests itself, as many people believe, in twitching muscles, trembling hands. These conditions are found only in advanced stages of Nerve Exhaustion.

The symptoms of Nerve Exhaustion vary according to individual characteristics, but the development is usually as follows: First Stage: Lack of energy and endurance; that "tired feeling." Second Stage: Nervousness; restlessness; sleeplessness; irritability; decline in sex force; loss of hair; nervous indigestion; sour stomach; gas in bowels; constipation; irregular heart; poor memory; lack of mental endurance; dizziness; headache; backache; neuritis, rheumatism, and other pains. Third Stage: Serious mental disturbances; fear, undue worry; melancholia; dangerous organic disturbances; suicidal tendencies, and in extreme cases, insanity.

If only a few of the symptoms mentioned apply to you, especially those indicating mental turmoil, you may be sure that your nerves are at fault—that you have exhausted your Nerve Force.

Perhaps you have chased from doctor to doctor seeking relief for a mysterious "something the matter with you." Each doctor tells you that there is nothing the matter with you, that you are organically perfect. But you know there is something the matter. You feel it, and you act it. You are tired, dizzy, cannot sleep, cannot digest your food and you have pains here and there. You are told you are run down, and need a rest. Your doctor may prescribe a drug, a nerve stimulant or a laxative. Leave nerve troubles alone. It is like making a tired horse run by towing him behind an automobile.

And don't be deceived into believing that some magic system of physical exercise can restore the nerves. It may develop your muscle but it does so at the expense of the nerves, as thousands of athletes have learned through bitter experience.

The cure of weak and deranged nerves must have for its basis an understanding of how the nerves are affected by various abuses and strains. It demands an understanding of certain simple laws in mental and physical hygiene, mental control, relaxation, and how to develop immunity to the many strains of everyday life. Through the application of this knowledge, the most advanced case of Nerve Exhaustion can be corrected.

I have made a life study of the mental and physical characteristics of nervous people having treated more cases of "Nerves" during the past 25 years than any other man in the world, over 100,000 cases.



PAUL VON BOECKMANN

Author of *Nerve Force* and various other books on Health, Psychology, Breathing, etc., and kindred subjects, many of which have been translated into foreign languages.

The result of this vast experience is embodied in a 64 page book entitled *Nerve Force*, a book that is especially intended to teach how to care for the nerves and how to apply simple methods of their restoration. It is filled with practical information on the application of deep breathing as a curative agent. The cost of the book is only 25 cents cash or stamps. Address: Dr. Paul von Boeckmann, Studio 69, 110 West 4th St., New York City.

This book will enable you to diagnose your condition satisfactorily. The advice given will be of great value to you and the advice will be of great value whether you have had trouble with your nerves or not. Your nerves are the most precious possession you have. Through them you experience all that makes life worth living. If they are deranged means to big doings and sensible to the higher phases of life—your mental courage, ambition, and temperament. The finer your brain is, the finer and more delicate is your nervous system, and the more imperative it is that you care for your nerves.

*Nerve Force* is not an advertisement of any treatment I may have to offer. This is proved by the fact that large corporations have bought and are buying this book from me by the hundreds and thousands for circulation among the employees. Physicians, Pharmacists, and mental health workers recommend the book to their patients. Health Ministers recommend it from the pulpit. Nerve specialists, Hygienists, Nervinists, etc. have so great a mass of valuable information been presented in so few words. It will enable you to understand your Nerves, your Mind, your Emotions, and your Body. Over a million copies have been sold during the past fifteen years.

### What Readers of "Nerve Force" Say:

"I have gained 12 pounds since reading your book, and I feel so energetic. I had about given up hope of ever finding the cause of my low weight."

A physician says: "Your book is the most sensible and valuable work I have ever read on the prevention of neurasthenia. I am recommending your book to my patients."

Reading your book has stopped that dreadful feeling of FEAR which paralyzed my stomach and digestion.

Your book did more for me for indigestion than two courses in dieting."

"My heart is now regular again and my nerves are fine. I thought I had heart trouble, but it was simply a case of abused nerves. I have read your book at least ten times."

"The advice given in your book on relaxation and calming of nerves has cleared my brain. Before I was half dizzy all the time."

"I have been treated by a number of nerve specialists, and have traveled from country to country in an endeavor to restore my nerves to normal. Your little book has done more for me than all other methods combined."





## "The Boss Didn't Even Know My Name"

"He said my face was more or less familiar and he remembered seeing me around, but he didn't even know my name until the I. C. S. wrote him that George Jackson had enrolled for a course of home study and was doing fine work."

"Who's George Jackson?" he asked. Then he looked me up. Told me he was glad to see I was ambitious. Said he'd keep his eye on me."

"He did too. Gave me my chance when Frank Jordan was sent out on the road. I was promoted over older men who had been with the firm for years."

"My spare-time studying helped me to get that job and to keep it after I got it. It certainly was a lucky day for me when I signed that I. C. S. coupon."

How much longer are you going to wait before you take the step that will bring you advancement and more money?

I take only a moment to mark and mail this coupon and send it to the International Correspondence Schools at Scranton, Pa. I better to do this today than to wait a year or five years and then wish you had?

### Mail the Coupon for Free Booklet

#### INTERNATIONAL CORRESPONDENCE SCHOOLS

1250 Locust St., Philadelphia, Pa.  
Official and largest correspondence school in the world.  
We grant our diploma only after you have passed the examination in the subject before us. We have been in business for over 40 years.

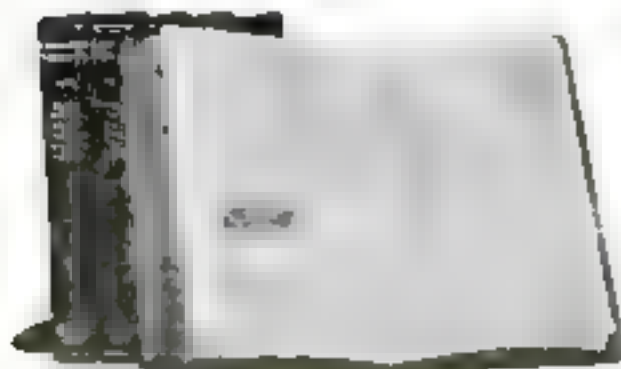
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| <input type="checkbox"/> Rubber Engineering     | <input type="checkbox"/> Glass Engineering     |
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## Inventive Genius on the Gridiron

(Continued from page 158)

In the open game of today, knees and thighs are the targets for more punishment than most any other parts of the player's anatomy.

Knee padding has been in vogue for many years, but it remained for Coach Spears of West Virginia to solve a problem that had puzzled for a long time. Formerly, football pants were so padded at the knees as to place the protection in place only while the player was standing. But much of his time is spent kneeling or crouching down. Spears has devised a shallow leather cup, felt-lined, which is so attached that it covers the knee cap completely at all times.

One of the latest and most elaborate appliances for helping in the training of a football team is a tackling apparatus patented by Charlie Moran, National League baseball umpire and coach of the Bucknell eleven. Moran's invention comprises an extensive framework from which are suspended dummies in such manner that they can be shifted to simulate the defense of any team that the users may expect to meet. The arrangement further permits setting the dummies in motion as the team starts its play, so as to have them in the approximate positions to which actual players would be expected to shift.

FOR all the sundry protective devices worked out, the game still takes its toll of injuries.

At the Kansas State Agricultural College, football players last season were given baths of ultra-violet light as part of their training. This treatment has been especially effective in ridding players of boils, on account of the light's great power as a germicide.

But baths of the light are given these players, too, to build up their strength and fighting qualities, and victory in more than one important contest has been imputed to the treatment. Recent research indicates that ultra-violet light helps in building up new red blood corpuscles. With a team battered to pieces, and another game scheduled for the coming week, a way to speed up the manufacture of red blood may decide the score. This innovation of light treatment in Kansas is an indication of how coaches are availing themselves of the very latest in scientific research.

Overs for baking out swollen joints, liniments and lotions for removing soreness and the like are all a part of the equipment of a big college team nowadays. Also, a brace for refractory knees has been devised which will enable a player, who otherwise would be relegated to the side lines, to scamper on the field and cut surprisingly active capers. Yes, and a few years ago, a brace was devised that enabled Eddie Hart, hard-plunging fullback of the Princeton Tigers, to rip through opposing lines although he carried a fractured vertebra in his neck.

Such necessity-born artifices of science and invention have had quite a hand in making possible the annual thrills on the gridirons throughout the country.

"I aint"  
"He don't"  
"It's me!"  
"You was?"  
"Can't hardly"



## What Are YOUR Mistakes in English

They may offend others as much as these offend you

If someone you met for the first time made the mistakes in English shown above, what would you think of him? Would he make your respect? Would you be inclined to make a friend of him? Would you care to introduce him to others as a close friend of yours?

These errors are easy for you to see. Perhaps, however, you make other mistakes which offend others without you knowing it. If you do, you know that you do not represent your words as you always say that the words you say and write are a satisfactory picture. To you they may seem correct, but others may know they are wrong.

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## Snares for Inventors

(Continued from page 20)

turer but one paid royalties to Selden. Henry Ford was not granted a license, and when he began shipping machines in 1903, he went ahead without paying royalties.

Selden sued, and the first court decision sustained the patent. On an appeal, the decision held that the principal claim was limited to a two-cycle gasoline engine. The four-cycle engine had not been in general commercial use when the patent was applied for. Ford and most of the other manufacturers had used a four-cycle engine from the beginning, and the Federal courts decided that the Selden patent didn't cover that in the combination. Half a million dollars was spent in this litigation.

The Selden patent was based on what are known as "combination claims," in which the invention consists of a new way of combining elements that already are known, to produce a new result. Most patents are issued on combination claims, because it is only rarely that anybody discovers something absolutely new. And a patent based on combination claims is no protection to the inventor if the device can be made to work by omitting any single element of the combination.

**AN INVENTOR** got a patent on a device to use in coal stoves to enable them to burn kerosene as fuel. It was a new idea and should have made him a fortune. Unfortunately, in drawing up the claims he had included in all of them a groove to catch any dripping of oil. As soon as the device was on the market and making money, a clever young man bought one, filed up the groove and found it would work just as well. Then he duplicated the device, all but the groove, and the courts held that the inventor had no redress. He had claimed more than he needed.

"However, most of the pitfalls that confront the inventor are of his own digging," said one of the foremost of American patent attorneys. "I am speaking now of the amateur inventor, and nearly all inventors are amateurs."

"The amateur is full of fear that somebody will steal his invention. He need have no such fear if he protects himself with documentary evidence of the date of the original conception of his invention and of each stage of its development. He should also have a reliable attorney search Patent Office records to see if the invention is really new. And, most important, he ought to make sure that there is a possible market for the device."

"That is the way the professional inventor works. He usually discovers the demand and then sets to work to supply it. Nine times out of ten he sells his invention before he applies for his patent, letting the purchaser get the patent while he turns his mind to another problem."

"The amateur nearly always demands a flat sum in cash—a million dollars is a favorite amount to ask. The professional, on the other hand, knows that an invention, no matter how useful, must be developed and commercialized and gen-

(Continued on page 161)

## U.S. PATENTS

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## Snares for Inventors

(Continued from page 160)

erally sells on a royalty basis, with a stipulation that his invention must be put on the market within a specified time or it reverts to him.

"Marketing an invention, even a good one, isn't always easy. Usually the market exists in the industry to which the invention pertains, but not always. The inventor of a new kind of soft collar, made of a special weave, met nothing but rebuffs from the collar industry. He finally interested some outside capital. Now the collar people all are making soft collars and already have had to pay several millions in royalties.

"Every railroad man, almost, has an invention or two to improve railroading, but few ever are adopted, because to do so would mean rebuilding an entire railway system. Costs entailed are out of proportion to the value of the invention. Even so simple a device as a self-locking nut for track bolts, which almost every trackwalker invents, would cost hundreds of thousands of dollars to adopt.

"**REVOLUTIONARY**, basic inventions are the hardest to sell, though they bring the best prices when sold. Let the inventor beware, however, of selling to an irresponsible or under-capitalized company. The most profitable inventions generally are improvements on existing devices that make them either better or cheaper, and these inventions usually are made by men familiar with the needs and weak spots of the particular industry. Yet bright amateurs sometimes do find the things that professionals have been racking their brains over for years. Remember that Fulton, the inventor of the steamboat, was an artist, as was Morse, who invented the telegraph; Bell, of telephone fame, was a school-teacher, and you have a vision of the possibilities."

## Machine Works Rapidly

SIX thousand reproductions of typed pages, printed pages, pen-and-ink drawings, or prints of woodcuts can be made in an hour, it is claimed, with a new duplicating machine called a "rotaprint," invented in Germany. Steel engravings also, can be reproduced, and the machine is adapted for architectural drawings and sheet music. Colors will reproduce one at a time.

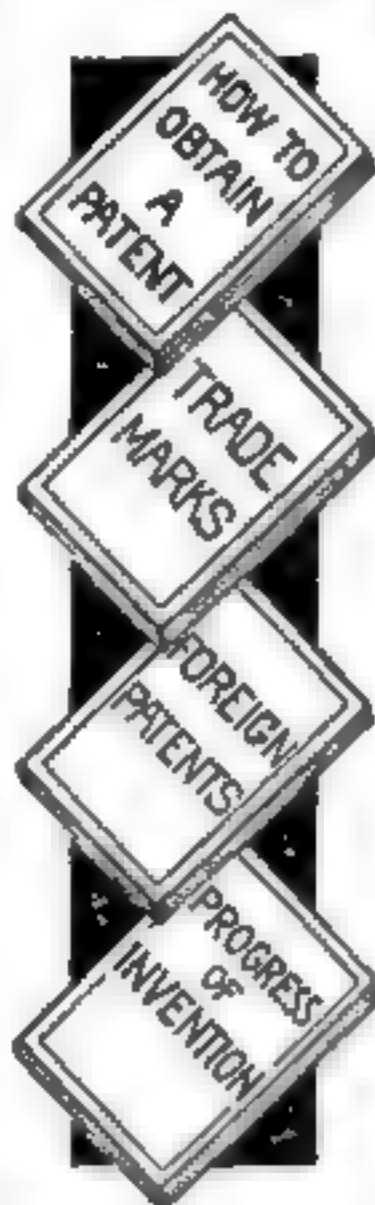
In the case of typed material, a stencil is made first, as for a mimeograph, and this sheet smeared with a chemical preparation is passed through a series of rollers, after which prints can be made.

## Experiments in Balloon

A BALLOONIST recently experimented to determine the distances at which he could hear various sounds. He could hear a man's shout at 1600 feet; frogs' croaking at 3000 feet, orchestra music at 4500 feet, church bells at 5000 feet, a rifle report at 5900 feet; and the noise of a moving train at 8200 feet. The whistle of a locomotive was heard farthest at 10,000 feet.

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By ALOIS MERKE

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How am I able to make this amazing offer? The answer is simple. The Merke System of hair growth is founded upon a very recent scientific discovery. I have found during many years of research and experience in the Merke Institute, Fifth Avenue, New York, that in most cases of baldness the hair roots are NOT dead. They are merely dormant—asleep!

It is an absolute waste of time—a shameful waste of money—to try to penetrate to these dormant roots with oils,

massages and tonics, which merely treat the surface skin. You wouldn't expect to make a tree grow by rubbing "growing fluid" on the bark—you'd get at the roots.

And that is just what my scientific system does. It penetrates below the surface of the scalp. It stimulates the dormant roots. It awakens them. The tiny capillaries begin to pump nature's own nourishment into them. Hair begins to grow again. It takes on body and color. No artificial hair foods—no rubbing. And

here's the wonderful thing about this system. It is simple. You can use it at home in any home that has electricity—easily—without the slightest discomfort.

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The condition of my hair is very good. After six weeks of treatment with the Thermocap my hair was covered with short hair and it was no longer dull and thin. I kept up the treatment and now I have as good a head of hair as any one could wish. *Charles J. Sprague, 128 South Cedar Street, Cedarburg, Ill.*

I used the Cap on 30 days when to my great surprise I found my hair was growing and my hair was as good as new. I have not started to come out. *J. Brown, 14 West Street, Englewood, N. Y.*

Your Thermocap has done a wonderful thing in giving me back my hair where all other things had failed. The top of my head is now entirely covered with hair after using the Thermocap for about two months and new hair seems to be coming in all the time. *Harry A. Brown, 21 Hampshire Place, Union, N. Y.*



## LEFT-LEAF SOCIALISTS

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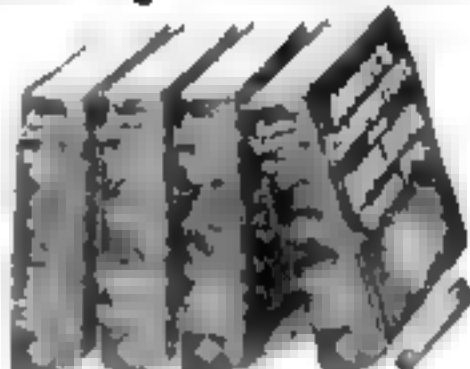
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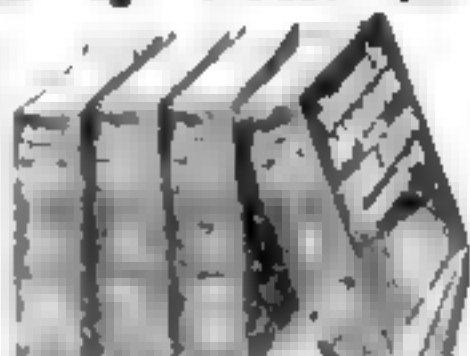
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At 2.57 p.m. the road was kept clear through the  
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Make model's milling surfaces on taking portion P3

**Sept 12th, Norwalk**

**1st** - State St. 1st & 2nd - 1st - Huber  
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how to write the code. I don't know how to write the code.

[illegible][illegible]

1. The above information was obtained from the files of the FBI, New York City, and is being furnished to you for your information.

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1. The first step is to identify the main topic of the document. This is usually found in the title or the first paragraph.

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Recontacted on 10 Jan 72. He is  
Regular Service Member and South

1. The first step is to identify the problem. This involves understanding the situation and the goals that need to be achieved.

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2. A. R. I. is a program designed to introduce the use of formal logic in the study of logic.

1. The first step is to identify the key components of the system. This includes understanding the hardware, software, and data involved.

ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED  
DATE 03-04-2009 BY 60322 UCBAW

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of the The National Question - interesting  
book. The book is a collection of essays on the  
national question in the United States. It is a  
very good book. It is a must read for anyone  
interested in the national question in the United States.

1. The first group of people who are not allowed to enter the country are those who are on the "No Fly List". This list is maintained by the Federal Bureau of Investigation (FBI) and the Department of Homeland Security. It includes individuals who are suspected of being involved in terrorism or other activities that could threaten the national security.

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At 10:30, a group of about 100 people gathered in the hall for a meeting. The meeting was held in the hall of the school. The meeting was held in the hall of the school. The meeting was held in the hall of the school.

Ⓐ This seal on a radio or test advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.



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## He Poked His Fingers in a Lion's Mouth

(Continued from page 35)

was far harder. The beast weighed 1½ tons and had such big feet and was built so close to the ground that it was hard to cast it. Ten men hobbled Mr. Rhino, tugged and tugged, and couldn't budge him. Finally, some one got the brilliant idea of building a hill with bags of grass and slowly heaving him over on it. Some job! But it was done, and after two operations the animal was able to see again.

Camels are a little easier to throw. This is necessary when something happens to their feet, as often does.

**M**OST of the troubles Doctor Blair has to contend with are digestive. Lions, camels, monkeys, bears, antelopes, larks, snakes, all suffer from digestive troubles. Castor oil and cod liver oil, of which the Zoo uses gallons and gallons, are in constant use. And it cures most of the digestive ills. But it doesn't cure the snakes. Snakes, when they are ill, refuse to feed and have to be artificially stuffed, which is quite a job. One snake, whose stomach was 5½ feet from its mouth, had to have rabbits, guinea-pigs, and chickens stuffed down his throat once every four weeks for a year.

Pneumonia gives the Zoo doctors much concern. Monkeys particularly suffer from pneumonia, for they are extremely sensitive to change in climate. Bronchitis, mumps, and other familiar diseases are common troubles with monkeys. And yet these all respond to treatment. Fresh air and inhalations of medicated vapors bring a ready cure.

As a matter of fact, much of Doctor Blair's work is preventive medicine. Anything that is likely to cause trouble is carefully avoided. Diets constantly are being experimented with. All the animals are studied and watched carefully.

Constant study has been absolutely necessary, for when Doctor Blair came to the Bronx Zoo, he had to form his own department. He was called there from McGill University in Toronto, where he was a student of the class of 1902 in comparative and veterinary medicine, to organize and develop the New York Zoological Society's medical department. That was 24 years ago.

**D**OCTOR BLAIR'S staff is small, but so well trained that every morning he gets reports that tell him the exact condition of every animal in the park. The three curators of the Zoo—Dr. William T. Hornaday, who designed the park, opened it November 9, 1899, and has been its only director, in charge of 565 mammals; Dr. Lee S. Crandall, in charge of 2474 birds; and Dr. R. L. Ditmars, in charge of 550 reptiles—report every symptom to the Medical Department.

Doctor Blair immediately investigates all cases that seem to require his attention. If necessary, the sick animal is removed to the hospital, the best equipped of its kind, with a surgical ward, a medical ward, an operating room, a hooped-animal ward, a diet kitchen, and a morgue, all conveniently arranged.

# From \$22.00 a Week Clerk to \$85.00 Radio Expert

How a young man discovered his opportunity in a fascinating new field, and quickly prepared himself in his spare time for the position he wanted. As related by himself.

**I** WAS interested in radio from the very beginning. I bought a little one-tube set when radio first became popular and I experimented with it, bringing in snatches of song from the air and trying to get distant stations. But my set was very much of a mystery to me. Like most people, I knew how to use it, how to tune in on local stations, but I did not understand how it worked. I often wondered!

"At that time I was working as a clerk in a large mail order house. I took the position because I thought it would be a stepping-stone and that I would quickly advance to something bigger. But years went by and I was still a clerk. Somehow I had fallen into a rut and there I remained. I used to get terribly discouraged at times and I wondered what my future would be. Would I never be anything more than just a clerk?

I drifted on, and nothing ever happened. I got an occasional increase in salary, but that was all. I was becoming resigned I was losing whatever shred of ambition I had left. My salary reached \$22.00 a week and there it remained. I knew I could never earn more in that kind of work. But what could I do? For what was I suited?

## A New Industry

Then came the big radio boom, and everybody began talking about the wonderful new industry. Half the people in our town bought receiving sets. On the trains I heard nothing but radio gossip, and the newspapers were crowded with news on radio development. I had a sudden idea—an inspiration.

"Here was an industry that was still an infant compared to other industries. It was young and fast-growing, and evidently would some day be one of the great industries in the world. Surely in so new and important an industry there must be big opportunities for beginners—a rare chance for quick success and rich rewards. I would get into the field at once, start at the bottom and grow up with it! I would get out of the rut into which I had fallen, into a new field ripe with opportunities.

But how? I had to depend too much upon my \$22.00 a week to give it up. If only I could study radio at home in my spare time, and prepare myself for a radio job without giving up my regular work. I decided to make inquiries and discovered that just such a course was offered by the National Radio Institute of Washington, D. C. I enrolled for their famous correspondence course, keeping it a secret from everyone at home.

"For several months I studied at home, in the evenings and whenever I could spare a half-hour or so. The time passed quickly because it was so fascinating. In a few months I had mastered what I had believed 'the mysteries' of radio, and was qualified to take a position in charge of a radio department in a large wholesale house.



"How surprised everyone was when I announced my new position. They had graduated from the National Radio Institute

and that I had my certificate as a radio-trician. They were even more surprised when I told them that the Institute had found a position for me right in my own town at \$85.00 a week! They all wanted to know how I did it—and some of the fellows were mighty jealous.

## I Earn Big Money

"Advancement came quickly, and now I am a radio engineer earning \$85.00 a week. Very often I earn extra money in my spare time helping people set up their sets. I expect another promotion soon and it won't be long before I am earning \$100.00 a week. Radio is constantly progressing, there are new improvements all the time, and those who are in the field naturally develop as radio develops. I am glad I got in early.

"I am glad to write this story for publication because the National Radio Institute alone has made my success possible. It offers an absolutely complete course which qualifies you for the Government first-class license and for the big-pay jobs in radio. I would advise anyone who is interested in radio as a profession to use this coupon and send at once for the valuable information that is offered free. Don't hesitate to use it, there is no obligation. I, too, sent off for the free information before enrolling. Why don't you do it—now?

## Special Offer

"A special reduced rate is being offered to those who mail the coupon AT ONCE. Get in on the ground floor and save money. Just address the National Radio Institute, Dept. 12 MB, Washington, D. C."

**National Radio Institute**  
Dept. 12 MB, Washington, D. C.

I am interested in radio as a profession. You may send me free and without obligation your interesting little book, *Rich Rewards in Radio*, telling about the future of radio and all information about your excellent home-study plan and your free employment service.

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Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_



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Men to manufacture Metal Toys and Novelties. Good chance to start your own well-paying business producing such big sellers as Toys, Novelties, Ash Trays, Book blocks, Souvenirs, Advertising Specialties, Paper Weights, etc. We furnish forms with complete outfit for speedy production. Absolutely no experience or tools necessary; no special place needed. Small investment puts you on road to success. Demand exceeds supply and we assist and co-operate with our manufacturers in selling their products. We put you in touch with the buyers and assure an outlet for your goods. Strictly a business proposition and thorough investigation invited. A splendid opportunity for an enormous and profitable business for ambitious men. No others will apply. Catalog and information mailed on request.

Metal Cast Products Co., 1636 Boston Road, New York



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Look often at once. Say "good-by" to bulging waistline. Amazing new belt literally melts fat away. Produces same result as expect tomorrow.

Off with that bulging waistline. Melt fat away. At last you can do it safely, easily, comfortably—and without great expense. Not by starvation diet or harmful drugs. There is only one correct way to take fat away—that is

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As it reduces fat, it builds up healthy firm muscles. It supports the stomach walls, improves digestion, gives better bearing. You feel years younger.

The Well Health Belt is made of the same kind of scientifically treated rubber that is used by professional athletes and jockeys. Endorsed by physicians. Write for description and special 10-Day trial offer. The Well Co., 1010 Hill St., New Haven, Conn.

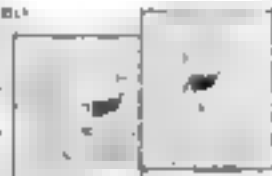
The Well Company, 1010 Hill St., New Haven, Conn.

Gentlemen: Please send me without obligation, complete description of the Well Scientific Reducing Belt and also your Special 10-Day Trial Offer.

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Michigan Ave. at 26th St.  
CHICAGO, ILL.

NOTE—To Art and Engraving Firm—Send for book and list of graduates. Write to us.

## How to Pick a New Boss

(Continued from page 32)

whom he can turn for such information. The value of tapping every available source of information about a job was remarkably demonstrated recently by a successful advertising manager who was drafted for an important executive position with a publishing house. At eight o'clock in the morning a total stranger telephoned to his home, with the request that he meet the stranger in his office at 10, to discuss a possible connection. Immediately the advertising man called up a number of his friends, asking facts about the concern and its owner. Two hours later he went to keep the appointment, having clearly in mind the past history and policy of the publishing house, as well as the record and reputation of the man he was to meet. As a result he was able to make a prompt decision, with a clear understanding of the conditions he would meet in making the change.

OF COURSE, most of us are not so fortunate in tapping reliable sources of information, yet often we fail to get the facts simply because we fail to try. The use of scientific methods is not the sole privilege of employers. More and more men who are seeking to better themselves are applying some of the same methods. Instead of doing all the answering of application queries, they are learning to put some pointed queries themselves. They are putting the boss on the carpet. They are picking studiously and carefully the man and the firm to which they may give the best possible service and as a result have the greatest chances for success.

## Recent Publications

*Biology*, by Vernon Kellogg. How to study biology for yourself, with a list of some of the best books about it. American Library Association.

*Man's Life On Earth*, by Samuel Christian Schmucker. A vivid, interesting story about what is known today concerning men who lived before recorded history. Illustrated. The Macmillan Company.

*The Wonder Book of Plant Life*, by J. H. Fabre, translated by Bernard Miall. A skilled observer of nature shares his knowledge of the marvels of plant growth. Illustrated. J. B. Lippincott Company.

*Plants and Man*, by F. Bower. Interesting essays on every-day botany. Illustrated. The Macmillan Company.

*High Lights of Geography—North America*, by David Starr Jordan and Katherine Dunlap Cather. A new kind of geographical reader for children that gives fascinating legends and stories of geology not found in the ordinary textbook. Illustrated. World Book Company.

*Automobile Starting, Lighting, and Ignition Systems*, by Victor W. Page. A comprehensive explanation of electrical systems for motorists, students, mechanics, and repair men. Revised. Contains 325 wiring diagrams. Illustrated. Norman W. Henley Publishing Company.

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Name . . . . .

Address . . . . .







## How to Charge Batteries

(Continued from page 62)

trade names by the makers of storage B batteries. These devices do not ordinarily employ a transformer. Consequently they are not capable of recharging the usual 110-volt storage B battery unless the battery is cut in two sections and the charging current sent through each section separately, or both sections are connected in parallel. The reason for this is simple. The line voltage in your house generally is not much more than 110 volts, while the voltage of the ordinary 110-volt lead or alkaline type battery runs up to nearly 120 volts when fully charged.

Figure 4 shows the connections to two double-pole, double-throw switches. This arrangement permits you to disconnect the B battery from the receiver, connect it with the charger, and also put the two halves of the battery in parallel for charging. Disconnecting the battery from the receiver is necessary, because otherwise there is chance of a short circuit from the electric-light line by way of the ground wire of the receiver.

**T**HE use of the second switch to change the battery from series to parallel can be avoided, of course, by using flexible leads from the charger and simply clipping one to each half of the battery. It will not require twice as long to charge the whole B battery this way, since the full charging current will flow through each half while it is connected with the charger.

You should use a hydrometer to determine the state of charge of the A battery, but you will find after a few months that the simplest plan, after all, is to give the A battery a charge once a week just as you wind the clock every Sunday. The battery should not be left more than two or three weeks without a charge anyway, and the amount of current put into your battery by any of the modern chargers will not harm it, even if you do charge it a few hours more than necessary now and then. In fact, an occasional overcharge is actually good for the battery.

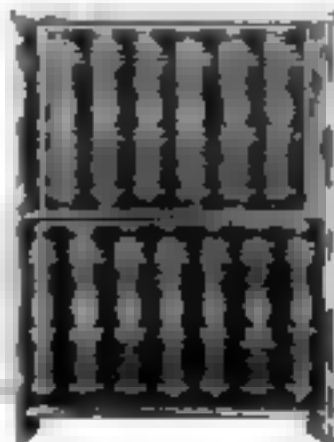
Storage B batteries of the lead type should be recharged for about 12 hours once every two weeks to keep them in good condition. The fact that the voltage of the storage B battery still reads up to 96 volts does not mean that the battery is not in need of a charge.

There is just one other vitally important point and that is: Be sure to keep the level of the solution in the battery above the tops of the plates at all times by the addition of distilled water whenever necessary.

**STEALING** radio programs may be the next crime. Invention of a way to fix sounds broadcast by radio on records was announced recently in Vienna, Austria. The broadcast sounds are recorded on disks on a spiral consisting of a continuous line of points more or less strongly magnetized, according to the strength or quantity of sound. The records may be played later any number of times. The disks may be demagnetized by a simple process and used again.

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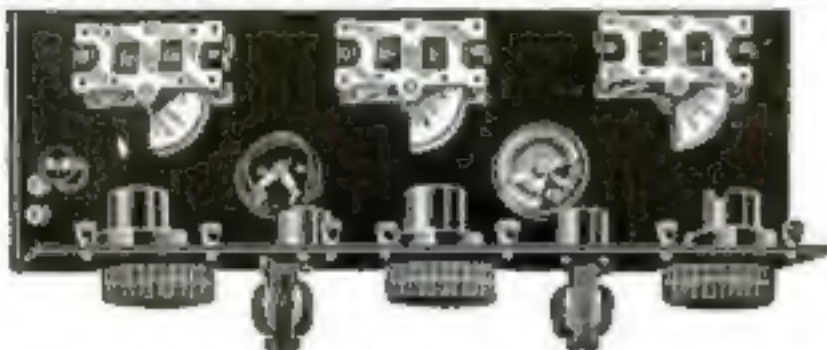
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